

# *Modern Refrigeration & Air Control*

61 No. 718

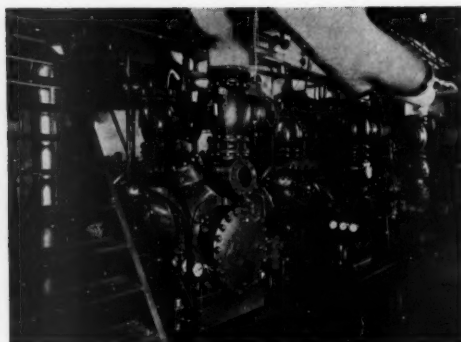
JANUARY, 1958

UNIVERSITY  
OF MICHIGAN

Price 2s. 6d. monthly

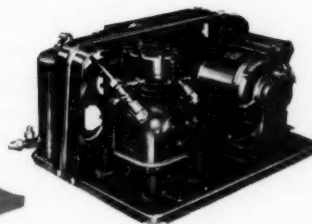
FEB 3 1958

ENGINEERING  
LIBRARY



J. & E. Hall Limited  
manufacture refrigerating  
compressors for all  
commercial and  
industrial purposes,  
ranging from  
1/6 h.p. to over 1,000 h.p.

**REFRIGERATION FOR  
ALL COMMERCIAL AND  
INDUSTRIAL PURPOSES**



**J. & E. HALL LIMITED** Dartford Kent REFRIGERATION, LIFT & ESCALATOR ENGINEERS

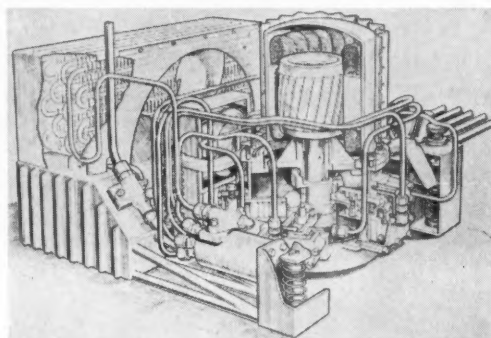
AP 115

*for Domestic or Commercial use*

**Sylvian**  
(REG'D)

*A universal **Serviceable** Sealed Unit*  
*with **UNIQUE** features*

- ★ LOWER TEMPERATURE MEANS REAL DEEP-FREEZE
- ★ OBVIATES PRE-COOLING AND SECONDARY CIRCUITS
- ★ WIDE VERSATILITY
- ★ DESIGNED FOR LONG LIFE WITH FREON 22



British Patent  
UK 680922

Australian Patent  
154195

U.S.A. Patent  
2738122

New Zealand Patent  
105246

While having the advantages of effective "Sealing" this Unit offers every facility for complete testing, maintenance or repair on the spot by ordinary Service Engineers using simple tools. Costly periods of enforced idleness are thus avoided. A special feature of the design is the interlock of main casings, giving exceptional rigidity, and long, trouble-free life. Readily adaptable to a wide variety of mountings, it provides an efficient component, as original or replacement, over a large field of operation.

SOLE MANUFACTURERS AND PATENTEES

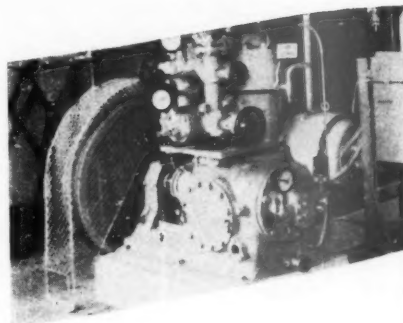
**WESTERN DETAIL MANUFACTURERS LIMITED**  
**WESTERN WORKS, STAPLE HILL, BRISTOL, ENGLAND**  
Telephone : BRISTOL 65-5097      Grams and Cables : ARIES BRISTOL 652825.

# MODERN REFRIGERATION

*and Air Control News*



*Incorporating*  
COLD STORAGE AND PRODUCE  
REVIEW  
*and ICE AND COLD STORAGE*  
Established 1898



*Editor-in-Chief:*  
**THEODORE A. RAYMOND**

*Advertisement Manager:*  
**J. A. Hutchinson**

VOLUME 61

NUMBER 718

## *Contents*

Editorial ...	34
News of the Month ...	36
Picture of the Month ...	37
British Domestic Refrigerators ...	38
Carriage of Bananas in Refrigerated Ships ...	40
All-Industry Show in Chicago ...	44
Ice Skating in the Tropics ...	47
New Milk Vending Machine ...	49
Automatic Control in the Refrigerating Industry ...	51
Road-Rail Containers ...	56
Low Temperature Road Transport ...	59
The Institute of Refrigeration Bulletin ...	61
Commercial and Industrial Section ...	63
Shop Refrigeration News ...	71
International News ...	88
Patents ...	90

### MODERN REFRIGERATION *Overseas*

The world-wide circulation of this, the original and oldest journal of the British Refrigeration Industry, carries "MODERN REFRIGERATION" by postal subscription into the following countries:—

ALGERIA, ARGENTINA, AUSTRALIA, AUSTRIA, BELGIAN CONGO, BELGIUM, BOLIVIA, BRAZIL, BULGARIA, BURMA, CANADA, CEYLON, CHILE, CHINA, COLOMBIA, COSTA RICA, CUBA, CYPRUS, CZECHOSLOVAKIA, DENMARK, ECUADOR, EGYPT, EIRE, FALKLAND ISLANDS, FINLAND, FRANCE, GERMANY, GIBRALTAR, GREECE, HOLLAND, HUNGARY, ICELAND, INDIA, INDONESIA, IRAN, IRAQ, ISRAEL, ITALY, JAPAN, KENYA, MADAGASCAR, MALAYA, MALTA, MEXICO, MOROCCO, NEW ZEALAND, NEWFOUNDLAND, NORWAY, PAKISTAN, PALESTINE, PATAGONIA, PERU, PHILIPPINES, POLAND, PORTUGAL, RHODESIA, ROUMANIA, SPAIN, STRAITS SETTLEMENTS, SWEDEN, SWITZERLAND, SYRIA, THAILAND, TURKEY, UNION OF SOUTH AFRICA, UNITED STATES, URUGUAY, U.S.S.R., VENEZUELA, WEST INDIES.

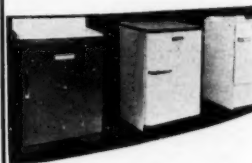
"M.R.", now in its 60th year of publication, has built up for its overseas readers special subscription and sales agencies in all the above territories.

★

Price 2s. 6d. net per copy.

By post 3s.

Subscription: £1 15s. per annum.  
including postage.



**Maclaren House,  
131 Great Suffolk Street,  
London, S.E.1.**

Telephone: HOP 5712  
Telegrams:  
Buns, Souphone, London

*January . 1958*

## Editorial . . . .

New Year—New Front

Fantasy or Reality?

Eskimos and Aborigines

● With the arrival of the new year—and may we repeat our expression of best wishes to members of the industry—has come a change in the format of our front cover. It could be argued perhaps that anyone needs a face-lift upon reaching the age of 60! ("M.R." achieves that venerable state in April of this year.) This hypothesis is exploded, however, when one realizes that our first issue, volume 1, April 1898, carried a single advertisement on the front, as distinct from the eight panels that have graced our outside for so long now. This change has alone been dictated by the powerful pulling-power that "M.R." exerts in the refrigeration and air-conditioning fields; in short, the desire for this restyling has been expressed by many of our trade supporters and we have now acted upon this advice.

● Any new year inevitably brings a spate of long-term thinking and the projection of novel ideas, some fantastic and some realistic. One that has made a strong appeal to the writer's imagination is that set forth in an advertisement in *The Times* of Mitchell Engineering Limited, London, and bears the initials of Ritchie Calder, science writer. Headed "Atomic heat to freeze the Arctic" it postulates a theory that may bring untold wealth to the frozen north. Briefly, the argument is as follows: "In the frozen wastelands of the Canadian north, Eskimos and Indians, going off to hunt the caribou or trap for furs, are taught how to prospect for the fuels and metals of the atomic age. . . . Those vast empty spaces, half the size of the United States, are already being systematically surveyed. Geologists, on the ground and from the air, are charting its fabulous mineral wealth. . . . Imagine 'industrial oases,' powered and heated by 'packaged reactors' and reached only by aircraft. The reactors themselves could be assembled by air supply (which has already served in the construction of the massive defence installations in the Canadian Arctic). Once the reactors are established and 'critical,' fuel-replenishment would be no problem.

● "Completely civilized townships could be created with adequate heat to counteract the climate, and modern amenities to enliven the Long Night . . .," claims Mitchell Engineering. "That raises another problem for which atomic energy could have a quaint answer. How to ensure all-the-year-round air-communications? The winter, contrary to popular belief, is the best time; the sea and lake ice can take the heaviest aircraft. The trouble starts with the coming of the sun. Ice thaws. Airstrips heave and toss and melt into mud, while the permafrost, the continuously frozen sub-soil and rocks, remains solid underneath. With sufficient power available, the airstrips and roads could be refrigerated and kept solid, like an ice skating-rink. Atomic heat to freeze the Arctic! It is like selling refrigerators to the Eskimos."

● Which reminds us that last month a major refrigerator company in London *did* sell a refrigerator to an Eskimo—in Regent Street (see page 65). So, maybe, the above "dreams" will become realities sooner than we imagine.

● Far removed from Eskimos and their contact with refrigeration are the aborigines of central Australia who were recently put to sleep in a refrigerator to test their resistance to cold. A mobile laboratory with a refrigerated sleeping compartment capable of producing sub-freezing temperatures was sent to Areyonga Mission, 150 miles west of Alice Springs—where the noon shade temperature was averaging 105° to 110° F. in December. A party of international scientists, led by Dr. H. T. Hammell, of the University of Pennsylvania, and including scientists from Norway and Alaska, is trying to solve the mystery of why desert aborigines are better able to withstand cold than white men. Last winter members of a similar scientific party slept in the open with natives in sub-freezing temperatures. While they suffered intense discomfort through shivering and teeth chattering, the natives lying beside them were apparently immune, and "snored their heads off." Scientists now want to discover whether this is seasonal or permanent resistance to cold.

● A news item that occupies only half a column in this issue we consider to be of profound importance to the industry. It is an announcement by our friends at Hendon of *price reductions*. Echoing what the "P.M." himself is sure to be saying, we exclaim: "Bravo!" May this move portend a general easing off in price levels where economies can be made. These price reductions (announced on page 80) represent,



say the particular company, a further stage in their development programme for commercial refrigeration and they have been made, despite increased cost of raw materials and labour, by increased volume and manufacturing efficiency.

● The highly successful 10th exposition of the U.S. air-conditioning and refrigeration industry, in Chicago's international amphitheatre, drew a record-breaking attendance of 14,752. Visitors came from every state in the union, Canada, and from about 25 other countries. The many thousands of exhibits emphasized the importance of the refrigeration cycle to the national economy, with emphasis on food preservation, drugs, industrial production and, of course, air-conditioning. Many companies showed production models of the heat pump, a fact which indicated that this efficient equipment for all-year heating and cooling is finding a market for itself. Sleeker, thinner room air-conditioners, a wide variety of colour for cabinets in the commercial refrigeration field, combination central heating and cooling systems, portable room air-conditioners and remote units for air-conditioning systems were among the newer items which attracted attention.

● The five milk marketing boards in the United Kingdom have recently prepared a joint specification for refrigerated farm tanks. The specification lays down minimum standards of farm tank design, construction and performance, and replaces previous specifications issued by the separate marketing authorities. Before refrigerated farm tanks can be installed on farms in the United Kingdom a specimen of each type must pass inspection and performance tests at the National Institute for Research in Dairying. All future tests will be based on the requirements of the joint specification which will be dealt with in more detail in these columns next month.

● Plans for the Grocery, Provisions and Self-Service Exhibition to be held at the Royal Horticultural Hall in June of this year, are now under way. Universal Exhibitions Limited, who are the organizers, believe that this linking of the food industry with self-service is a natural development. The reason, of course, is that this modern method of retailing has already had its greatest impact on the marketing of food to the general public. The scope for the first self-service exhibition to be held in Britain, with the rapid development of so many modern methods of retailing, is almost limitless. Not only is the food industry the largest in the country, but with already over 3,000 grocery self-service shops (being about 2.3 per cent. of the total grocery

production outlets) commanding 7 per cent. of the food trade, neither food manufacturers nor retailers will fail to realize the implications of this new and profitable method of selling.

## Long Service at Armstrong Cork



Thirty-one awards for long-service ranging from 10 to 30 years' employment with the Armstrong Cork Co. L'd., were presented by Mr. Kenneth M. Kent (managing director), on the right, and Mr. E. Malcolm Wood, deputy managing director, at the firm's Christmas party at Wembley Town Hall, Middlesex, last month. In addition to the gilt-and-enamel long-service badges bearing the Armstrong device, canteens of cutlery were presented to those reaching 25 years' service. Among recipients of awards was Mr. S. H. W. Richards (30 years' service), on the left in the picture, of Denham, Bucks, quality control manager, who joined the company in insulation contracts, of which department he was made sales manager in 1952. As an authority on insulation he is very well known and has lectured in all parts of the country.

Mr. Henry B. Seelig, Paseo de Marti 20, Havana, has told the British Embassy at Havana that he would like to represent United Kingdom manufacturers of: small combined electric motors and pumps (these are used in houses in Cuba for pumping water, and are of the type that are operated by the turning on of any taps throughout the house); electrical appliances used in restaurants, such as commercial refrigerators; small  $\frac{1}{2}$  h.p. air-conditioning units. Mr. Seelig is an American citizen in the late 50s and for some time operated a toy store named "El Bosque de Bolonia" which he sold in 1930. Since 1930 he has been engaged in the commission and representation business. He is considered to be a suitable connexion for United Kingdom firms.

# NEWS OF THE MONTH

**Refrigeration and A-c. Exports.**—During November 1957 air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £872,261 weighing 1,229 tons, was exported from the United Kingdom. Comparable figures for November 1956 were 1,225 tons, worth £838,762.

**Exports' Analysis.**—Of the 1,229 tons of air-conditioning and refrigerating plant worth £872,261 exported by Great Britain in November—quoted in the preceding paragraph—113 tons went to the Union of South Africa, 35 tons to India, 78 tons to Australia, 101 tons to New Zealand, 61 tons to Canada, 233 tons to "other Commonwealth countries," 22 tons to Eire, 25 tons to Sweden, 112 tons to Western Germany, 53 tons

to the Netherlands, 35 tons to Belgium, 30 tons to France, 37 tons to Italy, and 294 tons to "other foreign countries."

**Refrigeration Plant Classified.**—Of the total exports of air-conditioning and refrigerating machinery during November, quoted in the first paragraph, automatic power-operated refrigerating machinery accounted for 165 tons, worth £84,796, automatic heat-operated equipment for 25 tons worth £27,468, and non-automatic refrigerating machinery, including parts, for 257 tons, worth £144,971. Parts for all automatic power-operated machinery, weighing 541 tons, were valued at £415,304.

**Exports of Small Refrigerators.**—During November 1957, 795 tons of complete refrigerators (including complete mechanical units) of a storage capacity not exceeding 12 c.ft. were sent overseas from Great Britain. These exports were worth £437,823. The 795 tons comprised 56 tons to the Union of South Africa, 40 tons to Rhodesia and Nyasaland, 15 tons to India, 3 tons to Australia, 68 tons to New Zealand, 273 tons to "other Commonwealth countries," 1 ton to Sweden, 186 tons to Western Germany, 2 tons to the Netherlands, 11 tons to Belgium, 11 tons to Italy, and 129 tons to "other foreign countries."

**New Freezing Plant.**—A fruit freezing and storage plant costing £45,000 is to be erected by James Robertson & Sons Ltd., at their works in Stevenson Street, Paisley. Between 300 and 400 tons of fruit will be put into deep-freeze there every year. Previously the fruit has been stored throughout the country in Glasgow, Perth and Edinburgh.

**Ice-Cold Milk.**—The National Dairymen's Association are anxious to promote the sales of milk as a beverage and appreciate the importance of offering milk to the public ice-cold, when it is in a refreshing and palatable condition. Dispensers for pre-packed milk and for homogenized milk are already in use, but homogenized milk is not easily available in all parts of the country. The Association are, therefore, offering a gold medal to the firm which produces the most suitable machine for ordinary milk can in regular use. The N.D.A. gold medal will be awarded to the manufacturer whose entry, in the opinion of the panel of judges, best dispenses a measured quantity

Thirty Years' Progress—Convenience and functional styling emphasize 30 years of progress between the 1927 monitor top model (inset) and the latest "Straight-Line" refrigerator-freezer. Revolving shelves and roll-out freezer are main features of current type.



of pasteurized milk at a temperature not exceeding 40° F.; so continuously agitated as to conform fully to the requirements of the Food and Drugs Act; from an ordinary 10-gallon milk can in regular use in this country. Prototypes, not drawings, should be submitted to the Secretary, The National Dairymen's Association, 37, Queen's Gate, S.W.7.

**Tenth Liège Fair.**—To overcome the "sales resistance" on the part of some British firms towards participation in continental trade fairs, the 10th Liège International Fair is offering British manufacturers only all-inclusive prices for exhibition space and this includes, in addition to floor space, the construction of a stand, shelving, floor covers, sign writing, electric light, daily

cleaning, and, in some cases, even the services of one of the Liège Fair's hostesses to take down names and addresses of prospective buyers. Such an offer has never before been made by a continental trade fair, and, it is hoped will decisively influence British manufacturers, who up to now always argued that they could not accurately foresee what expenses, other than the price of floor space, they were letting themselves in for by booking a stand abroad. The fair will be sectionalized into twenty industrial groups. Group 12 will include "compressors, engines, generators and pumps." Group 16 will embrace machinery and plant for food manufacture, refrigeration, etc., while group 20 will include "industrial finishes and heat and cold insulation." The fair will run from May 10 to 26.

## PICTURE OF THE MONTH



Lightweight portable room air-conditioners were shown by a half-dozen or more manufacturers at the 10th Air-Conditioning and Refrigeration Industry Exposition in Chicago, marking a new trend.

(See page 44)





## 1958 WILL BE BUMPER YEAR FOR BRITISH DOMESTIC REFRIGERATORS



Frigidaire 9 c.ft. model.

**I**N these vital weeks before the new season's household refrigerator sales campaigns are launched there is much talk in the industry that 1958 will see new high levels of sales reached. Confidence is running high, for the British trade has, in its new models, world-beaters in the various size categories. Consider first the new Frigidaire line-up for 1958:—

**MY-32A & MY-32T.**—3.2 c.ft. models to suit the smallest kitchen. These models are available with left- and right-hand doors. Ideal for building-in, they are expected to achieve new record sales in 1958. A full range of colours set off beautifully the beige interior.

**MY-45A & MY-45T.**—“Master” 4.5 c.ft. refrigerators now have a beige interior, an interior light and a newly styled door. They are available in white and cream.

**DY-45A & DY-45T.**—These models, whose earlier counterparts were still breaking sales records even in the “credit squeeze” year of 1956, are extremely popular in their size-range. Beige interiors, trims on the front of the shelves together with the newly styled doors—these are the refinements for 1958.

**MY-94 & MY-111.**—Where the need for refrigeration in the home is appreciated to the full and where luxury at a moderate price is required, these

“Master” models come into their own. Butter, cheese and egg compartments, picture window hydrators and really useful shelves form the handy door store. The super-freezers will hold plenty of frozen food and the rest of the food compartments are designed to give maximum food storage space. They are available in all the Frigidaire colours.

**DY-94 & DY-111.**—Handy door stores, really convenient food storage areas and the full width super-freezer chests are just some of the features of these models which, added to the full range of Frigidaire colours, make them the big sellers they are.

## New Prestcold “Big Four”

**A**T the end of December, Prestcold announced to the trade a new “big four” domestic refrigerator. Many improvements have been incorporated in this new model, not least of which is the unusually large amount of storage space in the door with its two removable, easy-to-clean shelves. Retailing at 76 guineas (£79 16s.), which includes purchase tax of £24 5s. 5d., the makers feel that this model will answer the large demand for household refrigeration, especially where the



house-proud and discriminating buyer is concerned.

Some "star" features of this new fridge are :—

- Automatic temperature control ;
- Large table top with spill-guard ;
- Locking device as optional extra ;
- Automatic interior light ;
- Acid-resisting porcelain enamel interior ;
- Rounded corners inside for easy cleaning ;
- Unique Prestalok : no projecting handle ;
- Choice of right- or left-hand door ;
- Removable door shelves for easy cleaning ;
- Large deep chill tray for fish or meat cutlets.



The new Prestcold Big Four

Vital statistics of the "big four" are :—

*Gross capacity* : 4.3 c. ft.

*Shelf area* : 7.8 sq. ft.

*Outside measurements* : 37½ in. high (including spill guard), 22½ in. wide, 24 in. deep.

*Colours* : Cabinet star white or cascade cream : table top in matador red, crystal green, cascade cream, ice-blue or star white.

*Running cost* : About one unit a day.

*Frozen Foods* is obtainable from the manager, Maclaren House, 131 Great Suffolk Street, London, S.E.1, at fifteen shillings per annum, post free to any part of the world.

JANUARY 1958

## Optimism at Morphy-Richards's

At the twenty-first annual general meeting of Morphy-Richards Limited held recently at the registered offices, St. Mary Cray, Kent, the chairman, Mr. F. P. Bishop, M.B.E., M.P., said : "Our coming-of-age party last June was combined with the formal opening of the fine new factory at St. Mary Cray, which has doubled the productive capacity of the parent company. Almost simultaneously our largest subsidiary, Astral Equipment Limited, took possession of a new factory which has also doubled its productive capacity at Dundee.

"... it really does reflect great credit on all concerned that our group sales have once again exceeded all previous records. The parent company's sales topped £5,000,000 for the first time, while Astral sales at just over £900,000 showed an increase of 12 per cent. Against these figures we have to set some reduction in the turnover of our overseas subsidiaries. This is due mainly to the difficult trading conditions in Canada and Australia. Nevertheless our total export sales once again exceeded £1,000,000.

"At Dundee a new and larger model refrigerator has been in production since May. We have also collaborated with the Gas Council in the design of a low-priced refrigerator which will be sold exclusively through the Gas Council's area boards. The final design was submitted for tender to all interested manufacturers and the contract awarded to your Astral Company. Other new products are in active preparation.

"Within the last few months we have formed a new subsidiary company, Morphy-Richards Incorporated, in the United States, with sales and service accommodation in New Jersey. This company will develop the sales of Astral refrigerators for which there is a very substantial market, and will also explore the possibility of expanding the market in the United States for the parent company's considerable range of small appliances. We have also formed a new company, in association with a well-known German manufacturer, to act as the distributing medium for our appliances in Germany where market acceptance of our products appears to be entirely favourable."

**Gas Refrigerator Sales.**—During the 6 months ended September 30, 1957, sales of gas-operated refrigerators increased by 64 per cent. compared with the corresponding period of 1956. The number of these appliances sold from April to September was 14,900 as against 9,100 a year previously.



# The Carriage of Bananas in Refrigerated Ships

## THE EFFECT OF WRAPPING ON THE RATE OF COOLING

By G. MANN, Ditton Laboratory, Department of Scientific and Industrial Research

DATA on the effect of various types of wrapping on the rate of cooling of stems of bananas have been obtained in test runs made at Ditton. In each experiment the temperature range was approximately that met with in practice, but the velocity of air was varied over a wide range.

### *Experimental Methods*

The wind tunnel used for the tests had a working section 3 ft. 6 in. by 3 ft. 6 in. in which the air speed range could be varied from 10 to 1,300 f.p.m. To simulate the conditions in the spaces of some banana boats and to obtain air speeds down to 4.5 f.p.m., probably the lowest velocity used in practice, a diaphragm was placed across the tunnel in the fan section and two 6 in. dia. axial flow fans were fitted into it. By this arrangement an air speed of 4.5 f.p.m. could be obtained with one 6 in. fan and a speed of 8.5 f.p.m. with two 6 in. fans; higher speeds were obtained with the normal 33 in. dia. fan running at low revolutions. The tunnel was equipped with a finned pipe air cooler; brine was used as the coolant and the temperature of the brine was controlled within  $\pm 0.2^\circ$  F. The humidity of the tunnel air was raised by means of an electrically heated warm water bath, the temperature of which could be controlled to maintain a steady rate of evaporation, and the tunnel air humidity held at a constant level.

*The methods of cooling the bananas.* Three stems of bananas of approximately the same weight (58 lb.) and the same state of maturity (green) were collected from the wholesaler's depot on the afternoon of the day (Friday April 26) of discharge from the ship. The fruits were put

into a constant temperature room at  $54^\circ$  F. until the Sunday afternoon when they were transferred to a room at  $68^\circ$  F. to equilibrate at that temperature. In the meantime, the air in the room housing the wind tunnel was raised to  $68^\circ$  F. and the wind tunnel itself was set to circulate air at approximately  $50^\circ$  F. At 9.00 a.m. on the morning of Monday, April 29, the fruit was weighed and transferred to the wind tunnel, thermo-couples placed in position, the tunnel sealed, and the fan started. The three stems of bananas, one wrapped in polythene, one in straw, and one unwrapped were placed vertically across the tunnel, at right angles to the air flow. The polythene wraps had a sufficient number of ventilation holes to prevent an excessive accumulation of carbon dioxide within the packs. It might be thought that stowing the fruit at right angles to the air flow was unrealistic as the air flow would in practice most probably (except in certain Scandinavian ships) be vertical and parallel to the stems of bananas. However, the tunnel working section is horizontal and the fruit could not be accommodated in any other manner without risk of damage.

Temperature and humidity were continuously recorded; in addition, readings were also taken at half-hourly intervals. On the completion of a cooling run fan and cooling were switched off and the tunnel opened so that the bananas could warm overnight to about  $68^\circ$  F. ready for a cooling run at different air speed on the following day. To minimize risk of low temperature damage to the unwrapped fruit the cooling run was terminated when the lowest fruit temperature reached  $47^\circ$  F. or at the completion of 10 hours' cooling.

In three runs the tunnel air humidity was raised by the evaporation of water from a heated

water bath, the temperature of which was controlled so as to maintain the tunnel air at a humidity of 84 per cent. during the cooling run; the bath was placed upstream of the fruit. For the two runs at lower air speeds, no attempt was made to raise the humidity as it was felt that the lowering of brine temperature necessary to off-set heat input of the humidifier together with the low rate of heat transfer to the cooler coils would not result in an increase in humidity. Consequently for the runs at 4.5 f.p.m. and 8.5 f.p.m. the relative humidities were approximately 70 per cent.

*The measurement of temperature and humidity.* Provision was made for spot or recorded readings of the temperature of the air in the tunnel before and after it passed through the fruit, and of the temperature of fruit surface, fruit centre, cooler surface, and brine. For fruit surfaces (6 points) and centre temperatures (6 points) 40 S.W.G. copper-constantan thermo-couples were used, and for other temperatures 26 S.W.G. copper-constantan couples. Particular care was taken in the placing of the surface thermo-couples. A very slight incision was made in the skins of the fruit and the couple pressed lengthways into it; the leads were then secured to the fruit a short distance from the couple junction by an elastic band. The measurement of air temperature before and after the fruit was made by eight couples, four upstream of the fruit and four downstream equally spaced across the duct section. Humidities at points before and after the fruit were recorded on a calibrated humidity

recorder, the accuracy of the instrument being within  $\pm 2$  per cent.

### Results

The cooling curves for the stems of bananas wrapped and unwrapped at two air speeds are shown in figures (1), (2), (3) and (4). The curves in figures (1) and (2) are those of fruit surface and in figures (3) and (4) those for fruit centre temperatures. While the cooling runs were in progress measurements were made of the rate of production of carbon dioxide at temperatures of 20° C. and 10° C. of a few fruits cut from the same stems. The respiration rates obtained were at 20° C., 34.0 mg. CO<sub>2</sub>/kg./hr. and at 10° C., 9.0 mg. CO<sub>2</sub>/kg./hr. The loss of weight by evaporation from the produce during the cooling runs could be measured only at the commencement of the first run and at the end of the last run. To have attempted to obtain weighings after each cooling run would have meant disconnecting all the thermo-couples with the risk of displacing some of them. The observed weight losses for the five runs expressed as a percentage weight loss per day for the unwrapped, straw wrapped, and polythene wrapped were 0.99, 0.68 and 0.5 respectively. One sample (2.7 lb.) stored unwrapped in a room at 20° C. and 75 per cent. relative humidity lost 4.4 per cent. in weight in three days.

### Discussion

The effect of the wrapping on the rate of cooling is clear from inspection of the curves, but the

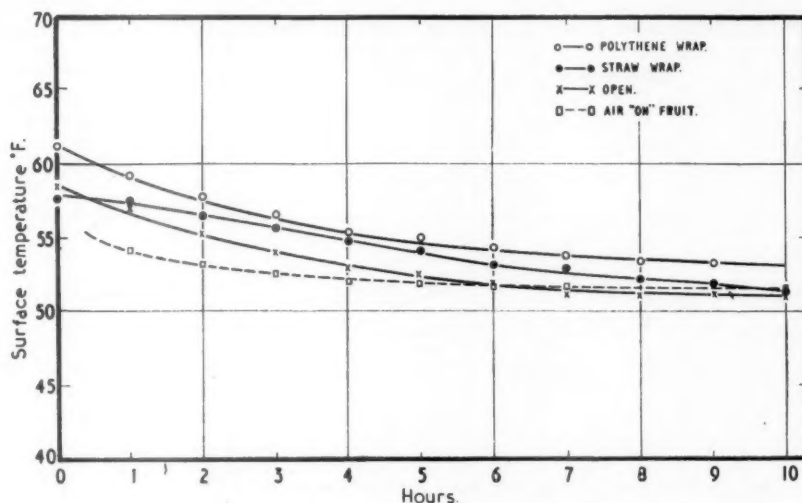


Fig. 1.—Approach velocity 4.5 f.p.m.

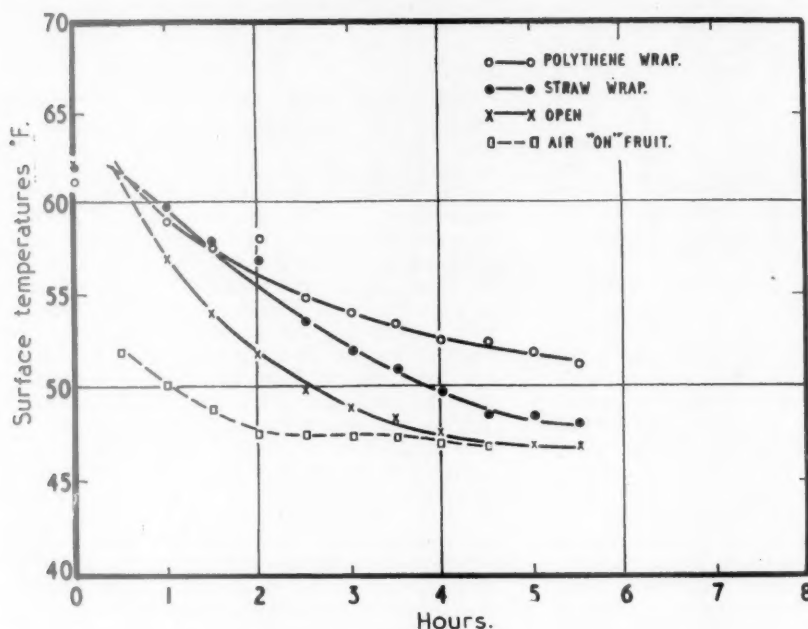


Fig. 2.  
Approach velocity 26.2  
f.p.m.

effect of air speed is not so clear. To show the effect of both air speed and the type of wrap on rate of cooling the results have been analysed and figure (5) shows curves of the rate of change of mean flesh temperature divided by the temperature difference between the mean flesh and air "on," plotted against the air approach velocity.

These curves (figure (5)) show clearly the effect

of air speed and the type of wrapping on the rates of temperature change of the bananas. In the unwrapped fruit the rate of temperature change was the highest, with the semi-open straw wrap intermediate with the polythene wrap.

In cooling the fruit from 69° to 54° F. in about eight hours it is unlikely that the rate of respiration will be seriously affected as it usually takes upwards

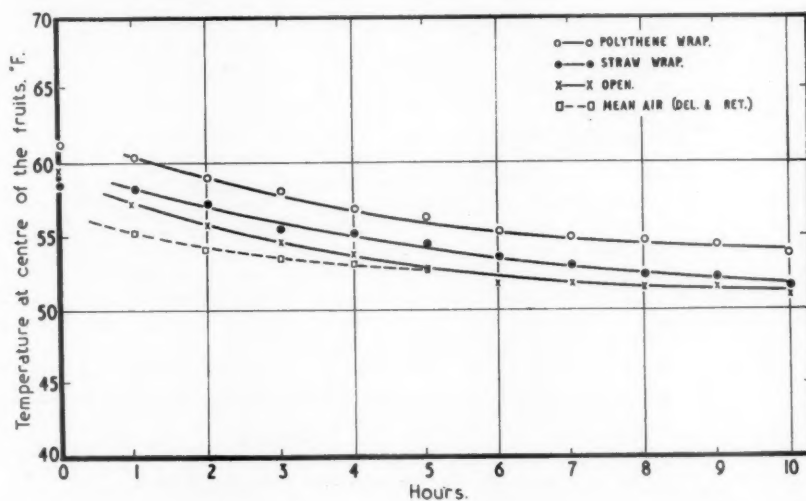


Fig. 3.  
Approach velocity 4.5  
f.p.m.

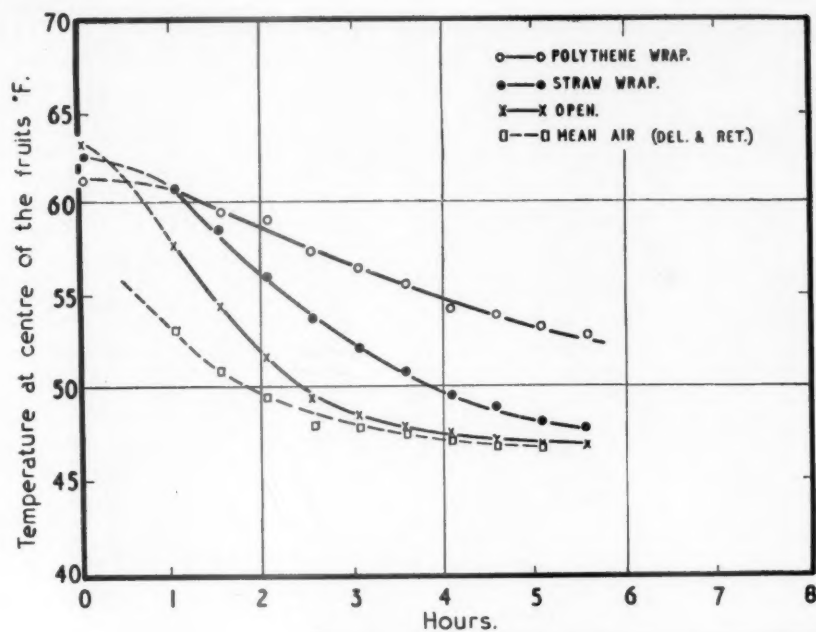
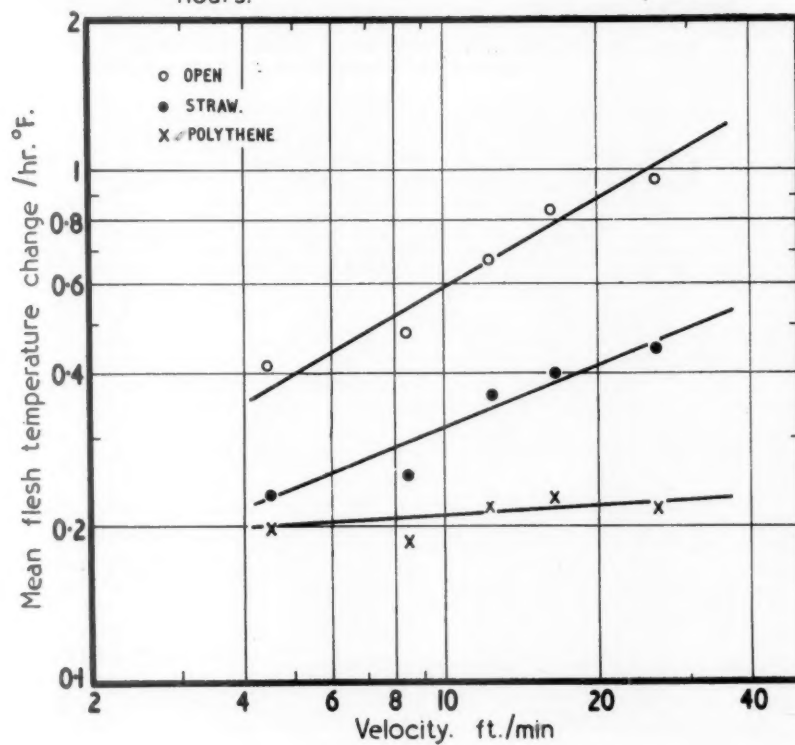


Fig. 4.  
Approach velocity 26.2  
f.p.m.

Fig. 5.



Continued on page 66



General over-all view of the exposition, at which 263 manufacturers exhibited their products. Total space occupied by exhibits was more than 94,000 square feet.

## Chicago Exhibition—Mecca of Refrigeration Engineers

**W**ITH the largest display in its history, the 10th Exposition of the Air-Conditioning and Refrigeration Industry at Chicago's International Amphitheatre in November, drew a record-breaking attendance of 14,752. Visitors came from every state in the union, Canada, and about 25 other countries.

The show, which included exhibits of 263 companies, exceeded the previous record-breaking show in Atlantic City in 1955 by some 13 per cent. in size.

Visitors travelled from Australia, Belgium, Brazil, British West Indies, Columbia, Cuba, Denmark, England, Finland, France, Germany, Hawaiian Islands, Italy, Japan, Lebanon, Mexico, Netherlands, Philippines, Puerto Rico, South Africa, Spain, Sweden, and the Union of Soviet Socialist Republics.

The show was sponsored by the Air-Conditioning and Refrigeration Institute. Eight national trade associations and technical societies held meetings in Chicago during the week of the show. They included the Air-Conditioning and Refrigeration Wholesalers, the American Society of Refrigerating Engineers, the National Association of Practical Refrigerating Engineers, the National Commercial Refrigerator Sales Association, the National Heating and Air-Conditioning Wholesalers, the National Warm Air Heating and Air-Conditioning Association, the Refrigeration and Air-Conditioning Contractors Association, and the Refrigeration Service Engineers Society.

Exhibits emphasized the importance of the refrigeration cycle to the national economy, with emphasis on food preservation, drugs, industrial



production and, of course, its most dramatic application, air-conditioning.

Highlights included the showing by many companies of production models of the heat pump, a fact which indicated that this efficient equipment for all-year heating and cooling is finding a market for itself.

Sleeker, thinner room air-conditioners, a wide variety of colour for cabinets in the commercial refrigeration field, combination central heating and cooling systems, portable room air-conditioners and remote units for air-conditioning systems were among the newer items which attracted visitors' attention.

A frequent cause for comment among visitors was the pavilion-like atmosphere of the huge amphitheatre floor. Blue-and-gold bunting, wide 20-ft. aisles and floral arrangements in the booths and along the aisles gave the show a warm, hospitable atmosphere.

The wide aisle arrangement made it possible to accommodate large crowds at peak hours without interfering with customer conferences in the booths.

The success of the show led to an immediate announcement of the next exposition. The 11th

Exposition of the Air-Conditioning and Refrigeration Industry will be held in Atlantic City, New Jersey, late in 1959 or early in 1960.

The American Society of Refrigerating Engineers held their 44th semi-annual meeting during the run of the show.

Such topics as "Automatic operation of refrigeration plants in the meat industry," "Present and future outlook for food preservation," "Immersion freezing of poultry," "Economics of coils v. fan or blower units for meat packing plants in 0° F. combination freeze and hold freezers," "Liquid ammonia recirculation application in meat packing plants," "Beef carcass chilling and holding" and "Packaged quick-freezing equipment," were some of the subjects discussed.

Active attention was paid, for the first time with ASRE, to central plant air-conditioning for multi-room buildings. Under the guidance of presiding chairman M. J. Wilson of Carrier Corporation the group explored the engineering and performance of such systems, the economics of air-conditioning large buildings, various installation problems and solutions and the refrigeration equipment available for such purposes in various types, sizes, forms and ratings.

A display of some of the automobile air-conditioners now in production in America was put on by a valve maker who specializes in parts for these units.



Among the fora, "What can ASRE do to interest industry in education?" with Professor M. K. Fahnestock of the University of Illinois as moderator, drew good attendance and pointed clearly to the growing concern of professional engineers in the problem of assuring competent technical successors to those staff members who accede to broader administrative, sales or technical duties.

Notable among technical sessions was an explanation of the "hows and whys" of the air cycle air-conditioning system used in the B-47. The air cycle was specified for this application because of its advantages in turbo-jet aircraft. Sizes of equipment are reduced but actual efficiencies remain much the same as for vapour cycle facilities. A 40 lb., 2 c.ft. unit produces 10 tons of refrigeration but requires 40 to 50 h.p.

Also of unusual pertinency were two presentations of refrigerating system components making operation and installation less subject to service interruption and maintenance. W. W. Sutherland of Westinghouse Electric described a digital-reading r.p.m. counter which provides accurate speed reading of hermetically sealed compressors. Simple circuitry provides the speed information from variations in motor current. This eliminates tachometers functioning by contact with the shaft and vibrating-reed indicators as well as cathode ray oscilloscope expense, complexity and inconvenience. Authors Guise and Krause of Ansul Chemical announced a simple moisture-indicating device for refrigerating systems, which by direct and comparative colour signals provides a continuing and clear guide for systems using either refrigerant-12 or refrigerant-22.

In approaching those problems related to the use of aluminium in refrigerating systems no less than six speakers assailed the topics from as many directions at the domestic refrigerator engineering conference. Thus, there was attention for tube-on-sheet and tube-in-sheet evaporators, for materials, processes and fabricating methods, for protective organic coatings.

An exploration was made by S. G. Eskin of the Dole Valve Company and W. E. Fontaine and O. W. Witzell of Purdue University into the phenomena allied with the removal of ice films from metal surfaces under different conditions and for various alloys and coatings. Here, several techniques and pieces of apparatus were integrated to determine the strength of the forces of adhesion involved. The actual force necessary for failure in the ice was recorded and correlated with the different materials used on test surfaces.

Similarly, the influences of insulation on the moisture condensation aspects of a steel-framed storage warehouse structure were exhaustively pursued by C. F. Kayan and R. G. Gates of

Columbia University. This study was based upon comparative-method study techniques and a network treatment in which the beam-length is divided into a number of cells or sections.

Professorial objectivity was likewise accorded in the study of thermal conductivity apparatus for operation near room temperature as undertaken by R. V. Dunkle and J. T. Gier of the University of California and J. T. Bevans of Shell Development Company. Here, the authors sought inexpensive means for rapid determination of the thermal conductivity of solids near room temperature. The method is predicated upon unidirectional heat flow through a thin sample placed between a heat source and sink. This paper was presented by ASRE past president Edward Simons (1952).

In presenting a sound yet simple formula for sizing evaporative cooling systems for greenhouses, R. S. Ash of International Metal Products Company substituted a rational and highly workable approach for what has long been a largely rule-of-thumb procedure.

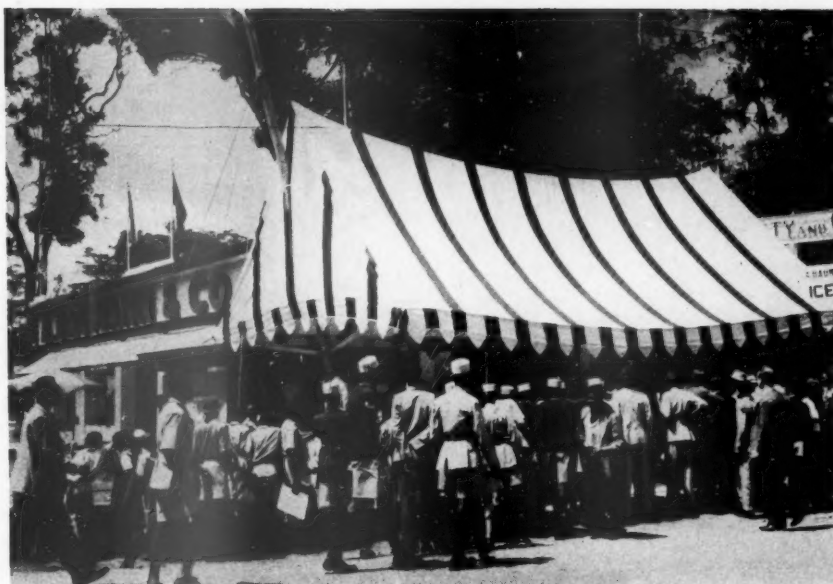
Study of the permeability of 12 types of plastics films to refrigerant-12 and nitrogen was reported upon by H. M. Parmelee of du Pont. The observations were established upon the use of a closed cell and measurement of diffused gas by mass spectrometer analysis. Based upon the twin contentions that anything that would increase the internal volume of a refrigerator without increasing the external dimensions would be a highly attractive sales feature and that refrigerator walls whose insulational interstices were filled with a heavy gas would offer greatly increased insulation, the author studied various plastics films which might be specified for the purpose.

Dividing the topic into five parts, speakers at the food preservation conference tackled successively dehydration, freezing and dehydrofreezing, radiation and canning and fresh products.

Other subjects variously developed at the 44th semi-annual meeting were refrigeration in candy manufacture, the problem of the correct installation of residential air-conditioning, small truck refrigeration equipment and compressor ratio and discharge temperature limits for refrigeration equipment.

There were two standards submitted for membership approval at this meeting, both of which were voted upon favourably. These were "Method of testing for rating forced-circulating air cooling and air heating coils" (ASRE-ASHAE) and "Method of testing for rating mechanical draft cooling towers under controlled conditions."

MODERN REFRIGERATION is indebted to the editor of *Refrigerating Engineering*, New York, for the above information on the A.S.R.E. meetings.



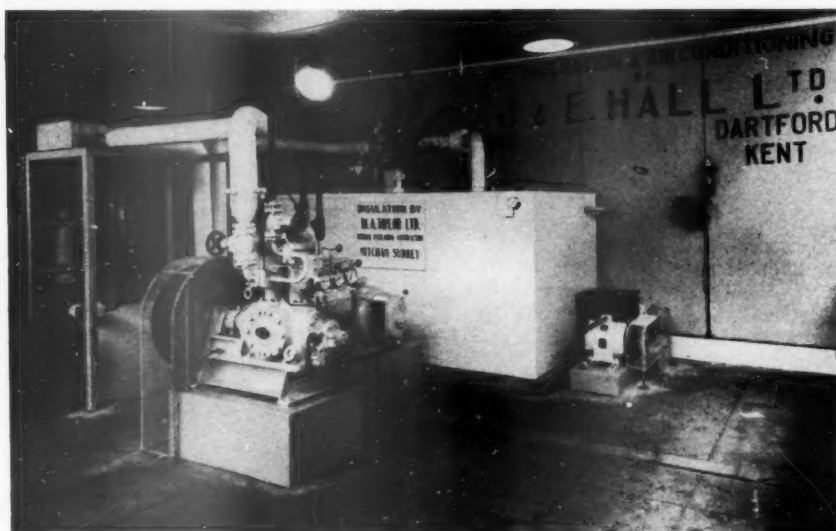
British ice rink at Nairobi show.

## SKATING IN TROPICAL AFRICA

In the trade section at the Royal Agricultural Show of Kenya, A. Baumann & Co., who are agents for Messrs. J. & E. Hall Ltd. in East

Africa, built an ice rink which was very well received by all races of the general public.

The ice rink measured 30 ft. by 16 ft. and was





Persons of many races tried out the ice rink.

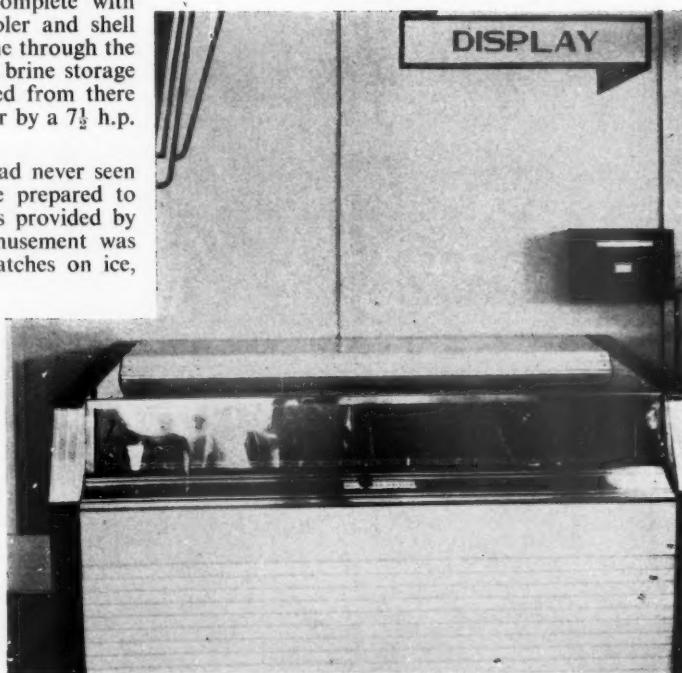


Commercial refrigeration was also presented at the show—in this case by a Hussmann British cabinet.

cooled by a J. & E. Hall  $6\frac{1}{2}$  and 4 by 4 ammonia monobloc compound compressor complete with air-cooled condenser, flash inter-cooler and shell and tube brine evaporator. The brine through the evaporator was re-circulated from a brine storage tank by a 3 h.p. motor and pumped from there through the grids in the ice rink floor by a  $7\frac{1}{2}$  h.p. brine pump.

Both Africans and Asians, who had never seen ice before in their lives, were quite prepared to try the art of ice skating with boots provided by Baumann's and a great deal of amusement was caused, and they put on boxing matches on ice, mainly between Africans, and the Sikh Indians took very well to the art of skating. Baumann's also had unrehearsed shows put on by one or two experienced European skaters who happened to be resident in Kenya, all of which created great interest in the press and put the refrigeration industry of East Africa in the forefront for a few weeks after the show.

The ice rink was erected in the open and a shade canopy was provided in the form of a white with black stripes canvas awning over the top, as can be seen in the photograph.





## Milk Vending Machine

### Refrigerated Cartons Automatically Delivered

TO drink milk in a factory or other place of work when one is thirsty is not so easily achieved when bottles, their storage and disposal have to be coped with, apart from the fact



that to really enjoy a glass of milk it should be fresh and cold.

That brings the added problem of refrigeration. Most factories in order to cope with demand would have to install massive cold rooms and a special staff and in these days of expensive space and high wages it is not a simple matter. This would apply also to the smaller types of business and offices too.

A new idea, born in Sweden, has overcome the container problem, it is called the "Tetra Pak."

This "paper" pack, specially treated and laminated to a heat sealing substance, is sterilized, formed into a tube and then fed into the specially designed machines which fill the tube with milk. At required intervals, which allows a container holding half or one pint to be filled, the tube is compressed and heat sealed, each seal being at right angles to the other thus forming a container shaped like a tetrahedron. The shape is convenient in many ways; it will nest and stack in and on itself, a great and necessary advantage when it comes to transport and vending, it stands

on its own without fear of toppling and it is easily opened.

It can be pierced and a straw inserted or the corner can be torn or cut, when the air rushing in will cause the sides to bulge slightly and the top level of the milk will drop sufficiently to eliminate any possibility of spilling.

The "Tetra Pak" is a most economic container and is so very much cheaper than its glass counterpart that it becomes more than economic as a "one-use-pack" and in no way therefore affects the price detrimentally to the consumer.

The advent of the "Tetra Pak" has now opened up all sorts of possibilities for the increased consumption of milk and all forms of non-carbonated soft-drinks and it only required the production of a suitable refrigerated carton vending machine to make these possibilities a reality. Farrow & Jackson Ltd. have produced such a coin-operated vending machine and as the illustration shows, this new "Coolamatic" carton vender is a compact piece of equipment which will deliver not only the milk but change for 6d. or 1/- as the case may be. It is 74 in. high x 29½ in. wide x 33½ in. deep, its unladen weight being 592 lb. and its weight loaded with 144 half pint cartons is 720 lb. Where it is desired to move the "Coolamatic" from, say, inside a shop to the outside for "after-closing-hours" operation, it is fitted with easy running castors, it being easily pushed through any normal "personal" door as the above dimensions indicate. There is also a light provided for night use.

This Farrow & Jackson machine is electrically operated, 10 or 15 amp. power supply being normal.

The machine is divided into two compartments, a large upper compartment housing the carton storage cylinder, the helical carton guide and refrigerator evaporator and a smaller lower compartment containing the refrigerator unit, vending motor, drive chain and sprocket.

Apart from an "unsuitable" coin mechanism, there are various other safety measures worth mentioning. An "empty" light on the instruction panel glows as soon as the last carton has been dispensed and a shutter drops in the coin mechanism thus preventing the insertion of further coins and in the event of a leaking carton becoming empty during the process of travel it will not be vended.

In addition there are ample fuses guarding the vending and refrigerating circuits.

### Convertibility

The Farrow & Jackson "Coolamatic" carton vending machine has also been designed so



that apart from being adaptable to other capacity containers it is also convertible to dispensing other forms of cold drink, not only in the "Tetra Pak" but in the "Satona" and "Perga" containers. The range of coin change given being in the following combinations:—

- a. One halfpenny.
- b. One penny.
- c. One penny and one halfpenny.
- d. Two pennies.
- e. One threepenny piece.
- f. One threepenny piece and one halfpenny.
- g. One threepenny piece and one penny.

Likewise the combinations of capacity and type of "pack" are as follows:—

- a. "Tetra Pak" 132 half-pint containers.
- b. "Tetra Pak" 180 six-ounce containers.
- c. "Satona" 180 six-ounce containers.
- d. "Perga" 144 half-pint containers.

Thus there is considerable range and adaptability available to suit changing fashions and demands without recourse to an entirely new machine each time.

The machine is normally supplied finished in white but other colours can be had to suit individual tastes.

Uses for this machine are legion, the first and most immediately obvious use is for "after-hours" sales at dairies and supermarkets. The housewife who has unexpected visitors or the family at the week-end who because the weather is fine go for the unplanned picnic.

Seaside resorts for holiday makers and visitors for the day, holiday camps and caravan sites, exhibitions and theatre queues are but a few of its possible locations.

Large office blocks where teenagers and others would welcome a drink of refreshing cold milk instead of tea!

Factories, canteens and workshops, some of which by the very nature of the work being carried out are dry, hot and dusty and a draft of cool milk not only slakes the thirst but is health giving too. No need to break off work, the boy gets the container which is thrown in the waste bin after use and causes no problem for disposal.

Outside on the land, building sites, mines, quarries, railway, bus and coach stations, mariners, yachting and motor boating centres, fêtes, fairs, garden parties, regattas, all can take full advantage of this new "Coolamatic" refrigerated milk or soft drink carton vending machine.

Farrow & Jackson Ltd., are located at 41-2, Prescott Street, London, E.1. (Royal 8401.)

#### THE ENTROPY CLUB

THE seventh annual general meeting and dinner of the Entropy Club took place at Beale's Restaurant, 368-374, Holloway Road, London, N.7, recently and was well attended by members from London and the provinces.

At the A.G.M., which was attended by 20 members, Mr. G. L. H. Bird was unanimously re-elected president and a new committee comprising Messrs. A. P. Arnold, B. W. Corston, B. J. M. Dye, H. Sleight, M. T. Tiley and G. E. Virgo was voted into office for the coming year. Mr. J. K. Hadley was elected hon. sec. and treasurer and the retiring hon. sec., Mr. Tiley, was thanked for his services in that post during the previous year.

As in the previous year, two official guests were invited to the dinner which was attended by 41 members and guests. The club's guests included Mr. N. S. Billington, head of the National College, and Mr. C. M. Brain, chief engineer of J. & E. Hall, who proposed the toast of the club.

Mr. Brain stated that he had learned that the club tried to invite a leading representative from industry and one from education as their guests. He said he was a little puzzled as to which side he was representing, being, as he was, closely linked with both sides.

He recalled how some 10 years ago he had helped to get a refrigeration course going at the Borough Polytechnic and told how Mr. Bird had been appointed to the post of senior lecturer for the course.

He continued by remarking on the rapid progress of

present day trends in refrigeration and compared these with his own early days in the industry, when there were no classes, no national college or Borough Polytechnic, and very few textbooks to be consulted.

He told the members that he was quite certain that he had met them all previously, since he made a point of seeing and talking to the students when they visited the works of Messrs. J. & E. Hall. It was good, he said, to see the genuine friendship that existed between members and admired the spirit of the club.

Mr. K. Aulds replied and thanked Mr. Brain cordially for his very good wishes for the club's future.

Mr. H. Sleight aptly proposed the toast to the guests.

Mr. N. S. Billington replied saying he was very privileged to do so especially as he had just recovered from an attack of sickness in time to attend. He said he had had rather cold feet with regard to refrigeration, since at the college he was more attached to the heating and ventilating aspects. However, he commended the club on the total heat of welcome extended to him, which he said was enormous. He said that a suitable collective noun for such a gathering could quite easily be "a purge of refrigerating engineers" (laughter). The Entropy Club, he continued, was a lively and vigorous organization and an asset to the National College.

Mr. A. L. Pearson, proposing the toast to the president, mentioned how pleased all the members were to see Mr. Bird in the presidential chair as in previous years, his leadership of the club being as welcome as in the past

Continued on page 58

Introducing an important new series

# Refrigeration Controls—I



By H. H. EGGINTON

● Harold H. Egginton was born and educated in Coventry and in 1941 was made a freeman of that city. He served an articled apprenticeship with the Standard Motor Company and during the war worked on aircraft engine failure with Standard Aero Engines Limited. In 1945 he joined the Pyrene Company Limited on electrical chemical work but four years later was appointed technical manager of the British Thermostat Company Limited, being made chief engineer of Teddington Refrigeration Controls Limited, a subsidiary of B.T.C., in 1954; last year he became works manager of the same organization. Mr. Egginton is an associate member of The Institution of Mechanical Engineers, an associate of The Institution of Metallurgists and an associate member of The Institute of Refrigeration, before which Society he read a paper entitled "Refrigeration Controls" in 1956.

## Introduction

This, the first of a series of articles on refrigeration controls, is intended to provide a practical approach to design, functioning and application of instruments to the control of refrigeration equipment. It is not intended that the series should delve too deeply into theory, but that it should be a useful introduction to controls, their characteristics, limitations, use and misuse. It will be quite obvious to anyone who has studied instrumentation that many volumes, let alone a few articles, could be written on this subject and therefore these chapters can only be an introduction and of necessity something will be missed out which someone will think to be of importance. However, to try and get a fairly comprehensive approach, the series has been compiled in sections which will be devoted to principles of instruments, different types of instruments from all parts of the world etc.

## SECTION I

### Principles

All instruments and controls can be resolved into three main parts:—

- (i) A prime mover or power element;
- (ii) The transmission;
- (iii) The contact or valve mechanism, otherwise known as the metering system.

Nearly all controls which are currently in use in

refrigeration practice are mechanical or electro-mechanical devices and there has been, to date, little development of the purely electronic type of device. Some progress has been made in this field in relation to temperature and humidity measurement and also in connexion with level control, but even these devices can be split up into the three fundamental main parts. It is the appreciation of the three basic components of an instrument which help in the understanding of their method of actuation.

### Prime Movers

Ignoring the special cases of elements for humidity sensing, solenoid coils, pistons, etc., all of which will be described in later parts of this series of articles, the principal prime movers can be split into two groups:—

- (1) Those which actuate by pressure, such as bourdon tubes, bellows or diaphragms;
- (2) Those which actuate by temperature, such as bi-metals.

Pressure-operated prime movers can be converted

to thermostatically-operated devices by charging them with liquid having a temperature/expansion characteristic or gas having pressure/temperature characteristics, or with fluids having vapour pressure/temperature characteristics, such as the refrigerants. By such a charging procedure a specific pressure is evolved for a temperature and therefore a pressure-operated prime mover is converted to a temperature sensitive one. Liquid expansion systems, where the volume of the liquid increases and causes a pressure operated prime mover to function, are very seldom used in refrigeration applications (*see figure 1*).

#### *Bourdon Tubes*

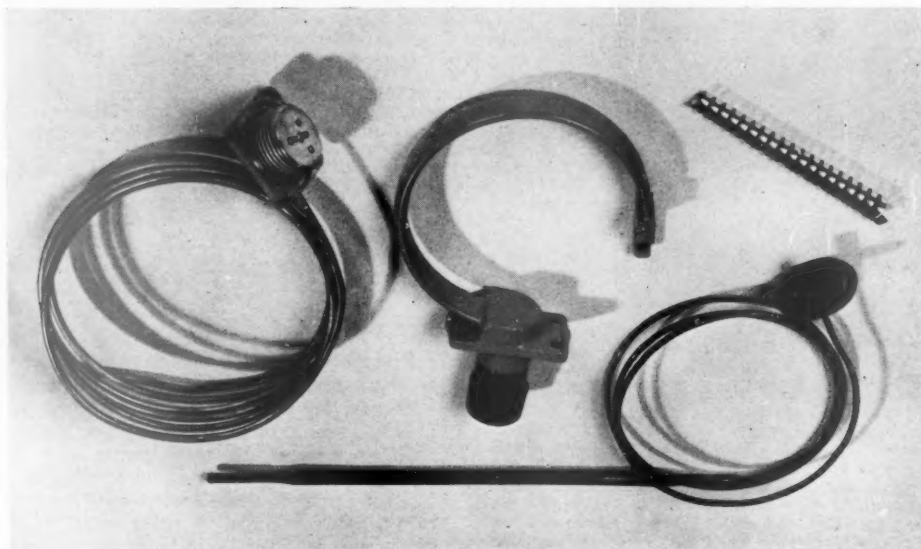
These are tubes, oval or flat in section, utilized in an arc form. They have the characteristic that the movement of the free end of the tube is

come circular and in so doing the arc form of the tube is straightened. Bourdon tubes are not so sensitive as bellows or diaphragms at the lower pressures, say under 500 p.s.i., but bourdon tubes are commonly applied from vacuum to 5,000 p.s.i. and find their greatest application in pressure indicating gauges, rotary thermometers and pressure cut-outs.

Bourdon tubes can be made from a variety of copper alloys, nickel copper, steel and stainless steel and as a result they can be applied to all the common refrigerants.

#### *Bellows*

The chief characteristics of bellows are that they have pressure/movement relationships which give linear characteristics and also that they have very definite effective areas on which internal or external

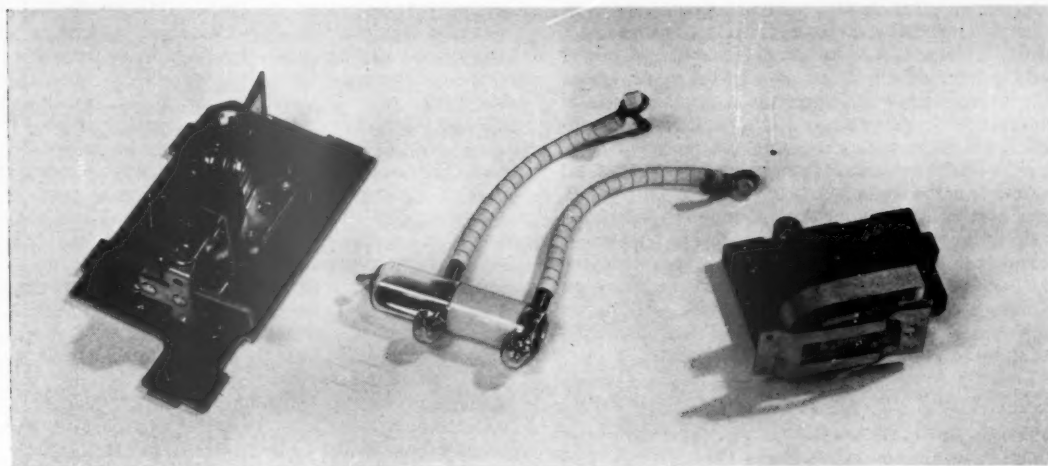


*By courtesy Teddington Refrigeration Controls Ltd.*

**Fig. 1.—Typical prime movers—bellows, bourdon tube, diaphragm and bimetal.**

linearly proportional to the applied pressure within the tube and this effect of linear movement with pressure is generally true to the elastic limits of the material from which the tube is constructed. The cross-sectional shape of the bourdon tube is dependent on the characteristics required in the movement of the tube, but tubes for accurate temperature measurement tend to be nearly flat rather than oval in shape. The principle of operation is that the application of pressure to the tube tends to cause the oval or flat section to be-

pressures can be calculated to thrust loads; generally, this thrust load in a bellows is high relative to its spring rate, *i.e.*, load required against unit deflection, such that a high power output can be achieved for a small pressure change. Fundamentally, a bellows can be regarded as an enveloped spring, having similar characteristics to a compression spring, of free length, solid length and spring rate; also linear rate characteristics which are, as in the case of the spring, confined to the elastic limit in compression and extension of the bellows



By courtesy Teddington Refrigeration Controls Ltd.

Fig. 2.—Typical switches—"C" spring, mercury tube and magnet types.

at solid and free length. Since bellows have such similarity of physical characteristics with the compression spring, the calculation of power output, performance, etc. is, generally speaking, much easier than with other forms of prime mover and these characteristics also tend to permit the design of pressure and thermostatic devices with longer ranges than is possible with some other forms of pressure sensitive power elements, particularly is this true when the power output requirement is high for a given change in conditions. In applications, bellows are not often used where their length exceeds their diameter, unless specific arrangements are made to support the bellows and avoid buckling.

Bellows are extensively used for pressure and thermostatic controls, particularly in valve mechanisms where thrust and movement requirements are high. They are available in the majority of common copper and copper nickel alloys as well as steel and stainless steel, so that they are applicable to all the refrigerants. In practice the pressure range of bellows is from vacuum to 400 p.s.i., although higher pressure types can be made. The commonest alloy for fabrication of bellows is 80/20 (copper/zinc) brass, because it gives the best all round combination of properties for fabrication and usage.

#### Diaphragms

Except over very small movement requirements diaphragms show non-linear rate characteristics, that is to say, the pressure change required for a unit of movement increases as movement

progresses. The diaphragm has an effective area as the bellows, but this largely depends on the convolution form introduced in the diaphragm and the extent of plain unformed regions as compared with the convoluted parts and as a result it is much less easy to ascertain the effective area of the diaphragm than a bellows. With considerable movement the effective area may also change on a diaphragm. Over a very small amount of movement near the mid position very low system rates can be achieved from diaphragms, but this system rate rapidly exceeds that of equivalent bellows if the movement attempts to approach the order of movement which one would expect from bellows-type prime movers. Generally speaking, a small number of fairly deep corrugations give better linearity of response in terms of movement for pressure change but shallow corrugations give a greater order of sensitivity. The principal utilization of diaphragms is in thermostats with relatively small control ranges, and in valves with small movement requirements. Diaphragms can be made in practically all common materials, metals, plastics, rubber, etc., but in refrigeration, stainless steel and beryllium copper are widely used.

#### Bi-Metal Prime Movers

Bi-metals consist of two layers of metal bonded together to form an integral whole, one of which has virtually no coefficient of expansion and is an Invar of 36 per cent. nickel iron or similar composition; the other has a specific coefficient of



expansion, being brass, stainless steel, etc. The effect of temperature, therefore, is to cause bending of the section as a whole and the result of power output is a direct function of change of stress. The principal use of bi-metals is in thermostatic measurement, particularly room temperature control but they are also used as compensating devices in the heads of thermostats so that an increase in the head temperature of a thermostat does not affect the performance and control is entirely based on the sensitive feeler section of the instrument. Bi-metals can give very sensitive performance, but the power output is not high if a high order of thermal sensitivity is required and, therefore, such devices have their principal utilization in actuating electrical switches.

### *Transmission*

The transmission consists of push rods or levers which take the thrust from a prime mover and transfer this thrust to the valve or contact mechanism. The push rod gives direct axial thrust and translates the precise prime mover movement, whereas the lever can increase or reduce the extent of movement. In the case of increasing movement by means of a lever, then the force available will, of course, be reduced and the reverse is also true. One point which has to be very carefully watched with the use of levers is the influence of non-axial forces which can produce hysteresis in the mechanism, since loads are translated under swinging arc conditions and not by direct axial thrusts. The ranging section of the instrument is usually associated with the transmission and is basically a cam or screw thread or other adjustment system which, by means of a spring, that is extended or compressed, alters the opposing load to the prime mover and hence alters the respective position for a given condition in the prime mover. This means that the respective position of the transmission is altered and hence the operating point of the metering section. Servo mechanisms are usually introduced in the region of the transmission and, in fact, a servo mechanism on its own can be considered to be a transmission system. The most common form of servo mechanism is the actuation of a minor valve by some prime mover which permits the transmission of pressure inherent in the system to operate against a piston, bellows or diaphragm, and by reason of the mechanical advantage of the effective area of these devices open a very much larger valve mechanism.

### *Contact or Valve Mechanism*

The final and third section in an instrument is the contact or valve mechanism which engages the transmission system. In the case of electrical switches the contact mechanism consists of

mercury tubes where the tube is tilted until the mercury bridges the electrodes and so transmits current, or silver buttons are brought into contact, one of them being on a lever, or alternatively, the lever carrying a shorting bar which produces contact between two current carrying buttons. It is most essential that the lever is given an unstable condition so that upon being depressed in one direction or another, produces a positive "fly through" action to make or break the contacts. This action is usually achieved by having a spring in a compressed or extended form; alternatively, a magnet attracting an armature attached to the lever can be employed. Such forms of construction of a switch effect the state of affairs that to move the contacts a given force has to be built up in the prime mover to overcome the spring or magnet forces; when this reaches a critical point, the lever flies through because the force opposing the prime mover decreases rapidly and a store of energy has been built up in the prime mover and transmission which causes positive "fly through." Valve mechanisms are, of course, very much simpler and merely consist of valve heads or needles which are forced against and lifted away from a seat by the transmission member (see figure 2).

Up to this stage, therefore, all instruments conform to the three basic requirements of prime mover, transmission, metering section, and they are all subject to the same basic calculation systems, such as:—

- (1) The stresses in the prime mover, which can be calculated as a force which is opposed by—
- (2) The force from the spring built up by the compression or extension introduced by the ranging device. The resultant force is transferred to the transmission member and—
- (3) By knowing the total force/movement characteristic which includes the prime mover, the ranging device and the metering section, a cumulative rate system can be calculated in terms of movement of the switch or of the valve. It should be noted here that in electrical switches with a sensitive snap action a switch spring rate may be in value equal to or greater than the combined system rates of the prime mover and ranging device. This is a function of the force and movement involved between the contact carrying lever and the magnet or snap spring mechanism.

It is of interest to note that not only do instruments as "individuals" resolve themselves into three fundamental parts, but the linking together of instruments can also be broken down into the same three fundamental parts; for example, consider a pressure-operated switch working an electro-magnetic valve which opens and closes as the result of the electrical switch action. The



pressure switch will be, in effect, the sensing element and electrical cables connecting the two devices together will comprise the transmission and the valve itself will be the metering part of the control. Therefore, the complete system is capable of analysis into prime mover, transmission and metering section, as well as the individual controls which in this case, say the pressure switch, would have a pressure sensitive element and a transmission operating an electric switch. The magnetic valve would have an electric coil inducing movement in the solenoid plunger which would then transmit

motion to a valve opening or closing it according to whether current was passing through the coil or not. Such a complete system could, in simple terms, also be referred to as a servo arrangement in so far as the valve would be connected to some form of fluid pressure system and its action of opening would change the pressure in that system to which the switch would react and, therefore, one would get a feed-back of information which would cause the pressure switch to operate and by feeding in electrical energy re-operate the magnetic valve.

*(To be continued)*

# BULLETIN NO. 5 OF THE INTERNATIONAL INSTITUTE OF REFRIGERATION

By EZER GRIFFITHS, O.B.E., D.S.C., F.R.S.

SEPTEMBER, 1957, was a busy month for the Institute; four commissions held meetings and there was also the annual session of the technical board.

Representatives of practically all nine commissions at the meeting of the technical board stated their programmes of work for the next two years.

The tenth international congress of refrigeration will be held in Copenhagen at the end of August, 1959. There will be three plenary sessions at which the following topics will be considered.

- (1) Application of refrigeration to human beings under its various aspects;
- (2) Refrigerated transport of perishable foodstuffs;
- (3) Recent developments and trends in the construction of refrigerated machinery.

As regards meetings of commissions: number three met at Delft. It considered the test code, the safety code, and nomenclature for refrigerants. Commission 4 met at Interlaken and considered two groups of papers, one the application of refrigeration to milk and dairy produce and two, the treatment of foodstuffs by ionizing radiations, especially concerning refrigeration.

Commission 5 at Lyons dealt with questions relating to refrigerated warehouses.

Commission 9 was particularly concerned with the following items:—The preparation of a technical multilingual dictionary in the field of refrigeration and compiling a system of nomenclature for refrigerants; this in conjunction with commission 3.

The bulletin gives the titles of the papers presented at the Scandinavian Refrigeration Congress held in Bergen in September, 1957.

It may be noted that an international congress of veterinary medicine is to be held in Buenos Aires and a symposium on food additives in Istanbul.

The bulletin has a section entitled "Current Research." In this issue reports on work in progress are given for organizations in Australia, Denmark, the U.S.A. and Great Britain.

Among the abstracts we note one on freeze-drying from Spain; one from the U.S.S.R. on "Calculations for a 'F.12' piston refrigerating machine." This deals with the effect of oil in the refrigerants and there are several other abstracts dealing with the effect of oil and of water.

Abstracts relating to mechanical equip-

ment include one on "Evolution of the design and construction of Loire refrigerating compressors." Others refer to mass production in France and centrifugal compressors.

From Czechoslovakia comes an account of big absorption plants.

Humidity control is the subject of several abstracts.

In the field of insulation we note papers on cellular expanded rubber, urethane and phenolic foams, and evacuated and gas-filled insulation systems.

Refrigerated warehouse construction is dealt with in several articles. We are told that the largest cabbage warehouse in Europe will cost about 800,000 D.M.

Problems of profit-earning capacity in the construction of refrigerated warehouses form the topic of one abstract.

Air-conditioning installations:—Heat pumps are represented by several abstracts; a few titles may be cited: "From 1936 to 1956: air-conditioning comes of age," "Justifying air-conditioning," "The economics of air-conditioning," "Basic conditions affecting air-conditioning in hospitals," "The problems of deep gold-mines in South Africa, especially air cooling."

Refrigerated transport includes transport by rail, road, and water. One abstract is entitled "Proposed standards for rating refrigerated trailers."

The gas liquefying industry has several abstracts: one is entitled "The industrial applications of very low temperatures."

In the section headed "Fruit" one abstract deals with dehydrofreezing which is partial dehydration and then freezing. A topic of interest to growers is "weight losses from apples during storage" another is on the storage and the ripening of *Passe-Crassane* pears.

In Belgium a laboratory has been established for the study of the storage of grapes.

In the section devoted to fish we note an abstract on "Storage of live crabs in refrigerated sea water."

One section of the bulletin carries the heading "Refrigeration and Mankind" and contains an abstract entitled "The use of frozen foods by restaurants."

We note that under regulations and standards there is an abstract "Swiss Standard TK29: Refrigerating plants—Problems of safety. Draft 1956."

The bulletin concludes with a long report in French only, "Biological applications of low temperatures. Tissue bank freeze-drying of natural products."



## Low Temperature Transport on the Road-Rail System

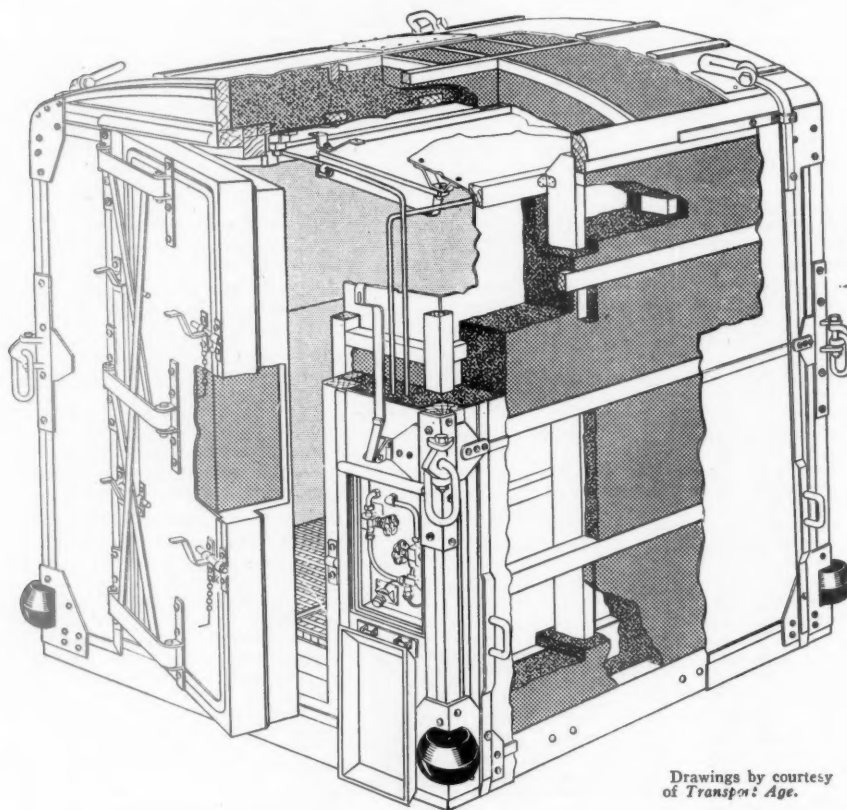
As we mentioned on page 480 of the last issue, Dr. F. L. Levy recently discussed, in *Transport Age*, the development of road-rail insulated containers as used by British Railways.

The interior dimensions of both AF and AFU containers are 5 ft. 10½ in. x 5 ft. 4½ in. with a height of 6 ft. 2 in., but the 193 c.ft. of space thus offered in the AF type is slightly reduced (by 10 c.ft.) in the AFU type—the space being occupied by the eutectic plates. Their maximum permissible load, as has been mentioned, is 3 tons. The tare weight of the AF containers is

1 ton 15 cwt., and that of the AFU type 2 tons 2 cwt.

The interior lining is made of galvanized sheeting with soldered joints so that the whole container can be easily cleaned. The thermal insulation of roof, floor and walls consists of 9 in. "Onazote" slabs; on account of its light weight (4 lb. per c.ft.) "Onazote" lends itself particularly to application on transport equipment. The total heat loss of AF or AFU containers is 10 thermal units per hour per degree difference between the temperature of the ambient atmosphere and that of the loading space of the container.

This means that, for example, the temperature of 3 tons of frozen food loaded at 0° will rise to about 5° in 24 hours if, during that period, the average ambient temperature is 65°. If the trader considers that this temperature rise is still too high, he may either load for the 24 hours' journey 62½ lb. of dry ice (2½ blocks of 25 lb.) with the load, or he may "charge" the hold-over plates of an AFU-type container. The plates contain a



Cut-away view of AFU container.

Drawings by courtesy of *Transport Age*.

so-called "eutectic mixture." The simplest form of a eutectic mixture is, for instance, water to which 23 per cent. of salt has been added in order to lower its freezing point to  $-6^{\circ}$ , instead of  $32^{\circ}$  at which pure water turns to ice. Thus, heat entering the container will first melt the frozen solution at its lower temperature before attacking the frozen load. To freeze the solution the trader has only to connect the low-temperature side of his refrigerating plant to a coupling located at the outside of the container in a box near its door, and to circulate his refrigerant for a couple of hours through a series of cooling coils which are incorporated in the hold-over plates.

If a trader makes use of dry ice as a refrigerant, he may often not be aware of the fact that some of his blocks may already have gained some experience in travelling with British Railways in another type of container. As the manufacturers

of dry ice maintain their supplies in a network of depots all over the country, they make use of a special type of "super-insulated" container for the bulk transport of dry ice at its sublimation temperature of  $-70^{\circ}$ . It is evident that this very-low-temperature commodity requires extra-thick insulation in order to protect it against heavy weight loss during transport.

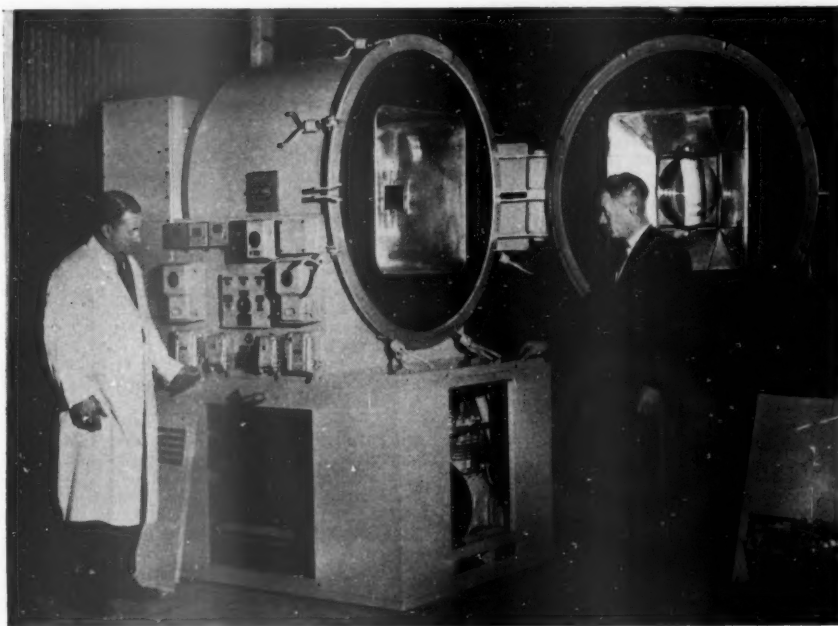
The high end of the transport temperature scale for foods is catered for by lightly insulated containers for meat. There are 4,500 of these "insulated meat containers" in use and another 1,000 which are ventilated for the purpose of providing air circulation through the load.

The development of low-temperature transport equipment for road and rail throughout the world is quite a fascinating story, and British Railways are fully aware of the implications of the increasing popularity of frozen foods in the national diet.

## Sub-Stratosphere Simulation

WITH the advent of Sputnik I and its successor Sputnik II many people are asking what Britain is doing about satellites and sub-stratosphere research in general.

At the Royal Aeronautical Establishment, Bedford, a new machine is in operation which duplicates the conditions found at the sub-stratosphere levels. The fact that delivery took place at the



same time as the launching of Sputnik I was entirely coincidental, but now research can be made which would otherwise have been impossible. The uses for this unique apparatus are many and varied: in addition to the valuable information which will be gained for aircraft and rocket applications, many other industrial experiments can be carried out where an unusual temperature or pressure is required.

The machine, which was specially constructed by Bedford Refrigeration Company, Bedford, from original plans by Prestcold Refrigeration, is designed to have a temperature range from  $-65^{\circ}\text{C.}$  to  $+60^{\circ}\text{C.}$ ; a range of  $125^{\circ}\text{C.}$ ! It also provides a range of pressures equal to altitudes from 1,000 ft. to 70,000 ft., so that aircraft components can be tested in conditions similar to those occurring during actual flight. A circular viewing window is installed at the front of the cabinet, so

that an observer can record the reactions of instruments. The window is constructed of five sheets of heavy armour plated glass set at a slight distance from each other in series, in such a way that visibility remains perfectly clear during the whole operation.

The actual test chamber itself measures 27 in.  $\times$  27 in.  $\times$  20 in., and this chamber is positioned inside a circular vacuum vessel, the over-all dimension of which is 4 ft. This outer case is made of heavy steel plating.

Refrigeration is provided by two Prestcold 3 h.p. compressors, which are run in two stages; the entire unit is automatic and can be set to any required temperature, which it will maintain for an indefinite period. In the tests held before delivery the reduction from the normal ambient temperature down to  $-60^{\circ}\text{C.}$  was achieved in an hour.

## New Companies

*The accompanying particulars of New Companies recently registered are taken from the Daily Register compiled by Messrs. Jordan and Sons Ltd.*

**Mobile Refrigeration Co. Ltd.**, 39-41, New Broad Street, E.C.2. Capital: £100. Directors: C. V. Ryan, 28, Lower Park, S.W.15 (ch); Doris V. Jarvis, Fashion Cottage, Exeter Road, Newmarket.

**Mobile Refrigeration Overseas (Holdings) Ltd.**, 39-41, New Broad Street, E.C.1. Capital £100. Directors: C. V. Ryan, 28, Lower Park, S.W.15 (ch); Doris V. Jarvis, Fashion Cottage, Exeter Road, Newmarket.

**Frigonics Ltd.**, 22, Crouch Hill, N.4. To buy, sell, repair and renovate refrigerators, etc. Capital £100. Permanent directors: W. Singleton, 23, Northumberland Park, N.17; H. Hammond, 33, Landrock Road, N.8.

**Armson, Jones & Co. Ltd.**, 17, Lambert Road, N. Finchley, N.12. Carry on business of importers, exporters, manufacturers of air-conditioning machinery, etc. Capital: £500. Directors: A. H. Armson, 107, Falconwood Road, Addington, Croydon; A. C. Jones, 17, Lambert Road, N.12.

**Clarke & Isbit Ltd.**, 88, Priory Avenue, Chingford, E.4. To carry on business of heating, air-conditioning, ventilating and plumbing engineers, etc. Capital: £3,000. Directors: M. Isbit, 88, Priory Avenue, Chingford, E.4; J. J. Clarke, 193, Romford Road, E.7.

**Thermal Insulation Ltd.**, 131a, Eltham High Street, S.E.9. Capital: £100. Directors: R. E. Palmer, 116, Southwood Road, New Eltham, S.E.9; R. Ballard, Flat 5, West Block, Coventry Hall, Polworth Road, Streatham, S.W.16.

**Refrigeration (Doncaster) Ltd.**, 33, Thorne Road, Doncaster. Capital: £1,000. Directors: S. I. Ryland and Mrs. H. A. Ryland, 27, Crossways North, Doncaster.

**Barnet Refrigeration Ltd.**, 4, Summers Lane Parade, N.12. Capital £100. Directors: F. A. Manning and Nancy W. Manning, 25, Southfield, Barnet, Herts.

**Thames Insulations Ltd.**, 776, Barking Road, E.13. Capital: £2,000. Directors: Alice Ayers, 113, Crofton Road, Plaistow, E.13; A. T. Hawkes, 96, Castleview Gardens, Ilford, Essex; R. T. G. Ayers and R. W. Williams.

**Walkers (Liverpool) Wholesale Ltd.**, 111/115, Marsh Lane, Bootle, Liverpool, 20. To carry on business of wholesale distributors of refrigerators etc. Capital: £100. Directors: H. B. Brailsford, Bye Ways, Victoria Road, Formby, Lincs; N. E. Harrison, Rockfield, Long Lane, West Kirby, Ches.

## THE ENTROPY CLUB

*(Continued from page 50)*

years even though Mr. Bird was now at the Borough Polytechnic where he wished him every success. Mr. Pearson recalled how some years previously he had attended a dinner of the club at which the marriage of Mr. Bird had been announced to the members. He personally was now very pleased to congratulate Mr. Bird on the arrival of a daughter, now three months old.

Mr. Bird, in his reply, said how pleased he was to see the club going from strength to strength and thanked Mr. Pearson for his kind words saying that he would convey the club's good wishes to his daughter! The club's success was, he felt, largely due to the genuine friendship and common interest amongst members and to the enthusiastic activities of the officers and committees. Referring back to Mr. Brain's speech Mr. Bird reflected upon how keen competition was as recently as 1939, and he was indeed glad that the small-minded attitude was now a thing of the past. Mr. Bird continued by reminiscing on his early experiences at the college. He said his first year was that of the R.2 course and told of his embarrassment on finding, as one of his students, one of his senior colleagues of his service days.

He then sought the permission of the chairman to ask everyone to pause and think of the many friends unable to be present with the toast "absent friends."

After the dinner the members spent the very congenial evening sitting around in small groups, renewing old acquaintances and discussing old times and subsequent experiences.

*The Entropy Club comprises ex-students of refrigeration at either the National College or Borough Polytechnic. Anyone who has completed a course in refrigeration at either of the above institutions and wishes to join the club is asked to contact the hon. sec., Mr. J. K. Hadley, 116, Elizabeth Avenue, Little Chalfont, Bucks.*

M. T. TILEY.

JANUARY 1958





## New Low Temperature Vehicle

**T**O cater for the varying needs of the several sections of the frozen foods industry many types of refrigerated vehicles have been produced, each being suited to the work of distribution either from the packing plant or from a wholesaler's premises. In other words, distribution is such a specialized business that it is not likely that a standardized van will ever be constructed that will meet the requirements of all and sundry.

A refrigerated vehicle that has just been built for Parrott & Sons, Ltd., Weston-Super-Mare, by Mann Egerton & Co. Ltd., has a body constructed in the form of a flat platform, with a panelled skirt, the upper half of the body having been fabricated as a container; hooks for the lifting off of this container are concealed behind small trap doors on the bevelled edge of the roof. The body has been mounted on an Austin 5-ton, forward control chassis.

The main frame of the body is composed of selected hardwood reinforced on all main points by mild steel brackets bolted to the framework; these brackets are so positioned that they cannot come into contact with the interior or exterior panels of the body.

The exterior panels are of 189 aluminium, butt joined, covered with half-round aluminium at all joints. The interior lining of the walls and roof are of 189 aluminium alloy sheets while the flooring consists of 189 galvanized sheets fixed to the floor. There are two ventilators at the far end of the body, with a ventilation space over the top of the insulated compartment.

Insulation comprises 4-in. Onazote, complete with bitumastic vapour seal to prevent condensation.

An uninsulated air lock is provided at the rear of the body and access from this to the refrigeration compartment is through a superfreeze door, construction of which is similar to the container itself, being insulated with 4-in. Onazote.

The refrigeration unit is mounted in this air lock and the unit serves Winget Dole holdover plates fitted to the inside of the container.



View through the uninsulated air lock into main compartment; on the right can be seen the refrigerating set.

### FROZEN FREE RADICALS

When a stream of nitrogen gas is heated up and passed through a high frequency electrical field, free radicals are generated; trapping them on a liquid helium-cooled surface results in solid deposits that emit a bright green glow, or give off blue flashes. Analysis shows that the radicals in question are trapped atoms of nitrogen in a high energy state. Similar experiments indicate that the familiar pattern of coloured stripes of the planet Jupiter, whose outer atmosphere ranges from 130° to 180° below zero centigrade, may be due to such frozen free radicals—primarily those from ammonia and methane. Jupiter's famous red spot may be due to cuprene, a polymer of acetylene, known to be formed when methane is illuminated with light of very short wavelength. So far, the isolation and use of free radicals in chemical reactions remains a laboratory-scale affair. But since by this technique chemists can produce and work with chemical fragments that cannot otherwise be obtained in quantity the approach may be used in the future to make new and unusual chemical compounds, or to make familiar compounds more efficiently, and use the result ever more widely in the refrigeration industry.

### MODERN HOMES IN SCOTLAND

THIS year's Modern Homes Exhibition in the Kelvin Hall in Glasgow recently had an impressive showing of refrigeration interests in the electricity pavilion and also in the main hall. The electricity pavilion was arranged by the South of Scotland Electricity Board as a centre for some 15 electrical manufacturers. Their stands were grouped immediately in front of the board's own platform stand which had two demonstration levels, allowing one to be used for the "appliance of the day" and the other for a working demonstration of a unit or make. The area behind was devoted to the "ultra modern electrical house of A.D. 2000" in which the board tried to predict the trend of things to come. They forecast that the housewife 50 years hence will merely switch on to her favourite food store by TV and push-button the goods she wants. These will be delivered to the house-door and placed in the external compartment of the new style built-in wall refrigerator, the push button controls doing the rest and switching the goods into the controlled temperature area for later use. Cooking and other ideas are also

on these progressive lines in this forecast of the future, one idea being that the room temperatures will be controlled by the body radiations of the occupants, which will react on the wall mechanism to provide coolness or warmth, according to the season.

Whether or not this was an accurate view forward—and only time will tell—the idea attracted a great deal of interest and resulted in very large attendances at the ultra modern house.

Among the firms showing were Superb Electrics Ltd.; Ferranti Ltd.—showing the fridge-heater;—Turber and Co. (Glasgow) Ltd., Glasgow, the Frigidaire specialists; William Kemp & Co. (Refrigeration) Ltd. who showed the Prestcold range, G.E.C., English Electric, Electrolux Ltd. and James Scott & Co. (Electrical Engineers) Ltd.

**Electric Hygrometers**, by Arnold Wexler, National Bureau of Standards circular 586, reviews the field of electric hygrometry—determining the moisture content of air (or any gas) by measurement of the electrical resistance of a hygroscopic material with change in humidity. The various humidity sensors are classified and discussed in accordance with their basic principles of operation, that is, their dependence upon (a) the conductivity of aqueous electrolytic solutions, (b) the surface resistivity of impervious solids, (c) the volume resistivity of porous solids, (d) the resistivity of dimensionally-variable materials, (e) the temperature of saturated salt solutions, and (f) the electrolysis of water. The simple circuits which are used to measure the resistance of the sensors are also presented. One section discusses the relative advantages and disadvantages of different types of sensors and the concluding section contains a list of further references on electric hygrometry.

Nguy Can and Fils, 121, Vithei Okhna In, Phnom Penh, have informed the British Embassy at Phnom Penh that they have a client who is planning to establish an ice plant and are interested in receiving catalogues, specifications, quotations, etc., for an ice plant of 20 tons daily capacity from the United Kingdom manufacturers as soon as possible. Nguy Can and Fils are a Chinese concern who have been established in Cambodia for more than 30 years. Their principal business is milling, marketing and exporting rice but they also import machinery, particularly anything that is useful in the rice industry. They are considered to be a suitable connexion for United Kingdom firms.

# The Institute of Refrigeration Bulletin

*Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.4 (Central 4694)*

## FEBRUARY MEETING

At a meeting of the Institute to be held at 5.30 p.m. on Thursday, February 6, 1958, at the Junior Institution of Engineers, Pepys House, 14, Rochester Row, Westminster, London, S.W.1, Dr. Audrey U. Smith, M.B., B.S., will present a paper entitled "The preservation of living cells and tissues at low temperatures."

The following is an abstract of Dr. Smith's paper:—

Since the time of Robert Boyle (1627–91) progress in low-temperature biology has depended on advances in chemistry, physics and engineering. By 1940 it was established that the majority of plants and animals and their component cells and tissues would not withstand freezing and thawing or storage at any temperature between the freezing point of water and the absolute zero. Survival at low temperatures seemed to be limited to organisms in which crystallization of ice could be avoided either by preliminary desiccation or by supercooling or vitrifying the tissue fluids. These views were upset in 1949 by the observation that glycerol would protect avian spermatozoa during freezing to, storage at, and thawing from low temperatures. Since then mammalian spermatozoa, red blood cells, skin, endocrine glands, nerves and ganglia, spleen, cornea, cartilage and a variety of other tissues have been preserved for prolonged periods in the frozen state in presence of glycerol at very low temperatures. This work, which has already led to a revolution in cattle breeding, offers new possibilities for biology, medicine and surgery. Future developments will depend, in part at least, on the availability of equipment designed by refrigeration engineers for maintaining temperatures in the range  $-79^{\circ}$  to  $-100^{\circ}\text{C}$ .

## MEMBERSHIP

At the meeting of members held on December 5, 1957, the following were elected to membership of the Institute:—

### Member

Bate-Smith, Edgar Charles, Low Temperature Research Station, Downing Street, Cambridge.

### Associate Members

Arnold, Alfred Peter, 42, Belmont Avenue, Alperton, Wembley, Middx.

\*Ashworth, Brian, 4a, Leith Close, Kingsbury, London, N.W.9.

Carter, Evelyn Peter, 20, Woodlands Avenue, Eastcote, Ruislip, Middx.

Evans, Richard, 25, Heathfield Park, Willesden Green, London, N.W.2.

\*Laight, David Henry, 16, Brook Croft, Marston Green, Nr. Birmingham.

†Lawson, Jack, c/o Q.P.C. Ltd. (A/C Dept.), P.O. Umm Said, Umm Said, Persian Gulf.

Meredith, Frank Harold, C.R.E. Mainland, Hong Kong, B.F.P.O. No. 1.

Rochester, Noel Joseph, 45, Adelaide Road, High Wycombe, Bucks.

\* Transfer from Graduate.

† Transfer from Associate.

## Associates

Cawley, Raymond James, 28, Windrush Valley Road, Witney, Oxon.

Doughty, Walter Gent, 36, Carlton Street, Church Square, Scunthorpe, Lincs.

Johnson, Brian Anthony Frederick, c/o Messrs. Werner & Co. Ltd., P.O. Box 612, Kitwe, Northern Rhodesia.

## Graduates

Legge, David Robin, 45, Rippington Drive, Old Marston, Oxford.

Sanders, John, 11, Purcell Road, Marston, Oxford.

## Student

Hone, Li Khay, 38, Highbury Grove, London, N.5.

## A Quick-Freezing Plant for Deep Sea Trawlers

**I**n a paper which they presented before The Institute of Refrigeration last month Mr. G. C. Eddie, B.Sc., A.R.C.S.T., A.M.I.MECH.E., A.M.I.NST.R., principal scientific officer, in charge of the engineering section, Torry Research Station, Department of Scientific and Industrial Research, Mr. R. T. Hales, A.M.I.MECH.E., M.I.NST.R., M.A.S.R.E., and

Mr. D. W. Higham, A.M.I.MECH.E., discussed "The development of a quick-freezing plant for deep sea trawlers."

"About half of the white fish landed in the United Kingdom is caught by 300 large trawlers fishing the arctic grounds. The fish, mostly cod, is preserved after gutting and washing by stowage in crushed ice. The voyages last on the average somewhat over 20 days. Fish is so perishable that a good deal of the arctic catch is of poor quality by the time it is landed, some of it being condemned. Very little of it is fresh enough to give a first-class product if frozen in factories at the fishing ports. For this reason it is not possible to preserve the fish that is landed in excess of requirements at certain times of the year. During the winter months, fish is difficult to catch, the voyages are longer, the quality is often poorer, yet the fish commands a high price because of its scarcity," stated the authors.

#### Freezing at Sea

"The quality of the distant-water catch might be raised by various methods, e.g., antibiotic ices; alternatively, such improved methods of preservation could be used to allow the trawlers to remain slightly longer on the fishing grounds. But it is only by freezing the fish when it is fresh and by proper cold storage thereafter that a product can be obtained that is not only of high quality but virtually imperishable and thus allowing any extension of fishing time that seems economically desirable and also solving the problem of seasonal gluts and scarcities.

"Mother ships fed by a fleet of catchers have been used in the past to freeze various fishery products, but it can be said that when this method is studied in relation to the arctic cod fishery it becomes apparent that there may be problems that could be solved only by full-scale experiment, which would be very costly. The successful post-war ventures in freezing at sea have all employed independent trawlers freezing their own catch.

"The first successful venture of this type was the *Fairtry*, a factory trawler which freezes the whole catch, mostly in the form of catering packs of fillets. The outstanding feature of this type of vessel, now being built by Britain, Germany and Russia, is its great size and cost compared with the largest of the orthodox arctic trawlers, the displacement being roughly over double, the cost roughly three times and crew roughly four times as big. The voyages are necessarily very long in order to obtain an economic catch. The adoption of this type of vessel therefore poses a number of problems to the trawler owner.

"The development of a plant suitable for existing trawlers also has the advantage that the design of the vessels can evolve gradually, with respect to size, and owners who adopt freezing at sea do not have to commit themselves to a much larger type of vessel requiring different facilities, nor ask their crews to undertake much longer voyages.

"The vertical plate freezing plant whose development is described here is, of course, equally suitable for factory trawlers if some, or all, of the catch is to be frozen whole; suitably modified it may be applicable also to the freezing of fillets or steaks, but it has not been tested for this application under industrial conditions.

#### Operations Research and Commodity Testing

"The engineering development of a suitable freezer was only one part of the development of an installation suitable as a whole for freezing cod and allied species on a distant-water trawler. It was necessary, for example, to determine the throughput of plant required to match the likely rate of catch and to determine exactly how the fish should be treated before and after freezing in order to produce a first-class article when thawed. The catching rate averaged over a distant-water trip may vary from less than  $\frac{1}{2}$  ton/hour to over 1 ton/hour and it varies from haul to haul between zero and 6 tons per hour. These violent fluctuations have a bearing upon the temperature of storage employed for

the frozen fish. In order to keep the freezing plant to a small and economic size it is necessary to "buffer store" the fish before freezing so as to regulate the flow of fish to the freezer. It was found that if the fish were gutted, washed and stowed carefully in crushed ice, they could be kept for up to three days before freezing, when necessary, provided that they were subsequently stored at  $-20^{\circ}\text{F}$ . These researches, carried out at Torry Research Station, have been described in some detail elsewhere.

#### The "Northern Wave" Project

"As a result of discussions between the White Fish Authority and the Trawler Owners' Distant Water Development Committee it was decided that these bodies, together with H.M. Government would finance an experiment to test the practicability of freezing the early part of the catch of a distant-water trawler of normal type, on the full commercial scale. The prototype Torry vertical plate freezer, and its products, were demonstrated and it was decided to adopt this type of plant for the experiment. Tenders were invited for a production prototype and a much improved version of the Torry freezer (described later), was the result. The S.T. *Northern Wave* was chartered and equipped. A series of harbour trials revealed defects, also described, which necessitated some modification of the installation. The *Northern Wave* finally sailed for the fishing grounds on December 31, 1955, and was operated under charter for eight voyages. Some 280 tons of frozen fish was produced, representing 25 per cent. of the total landings, or on average, the first  $2\frac{1}{2}$  days catch. The fishermen found no difficulty in operating the plant, or in working in the cold store. The product proved highly acceptable to the consumer. As a result of experience gained on the *Northern Wave* it is possible to specify an automatic plant suitable for the standard steam trawler."

The main purpose of the paper by Messrs. Eddie, Hales and Higham was to describe the development of the plant which has several features of technical interest.

#### The Torry Prototype Freezer

"Attempts at freezing herrings in bulk in tapering moulds similar to those used in the manufacture of ice, led to the construction of a vertical plate freezer which produced 63 lb. slabs of quick-frozen fish  $4\frac{1}{2}$  in. thick. The original model designed and built at Torry was tested on the 90 ft. M.F.V. *Keelby* and used for the commodity experiments described earlier," went on the authors.

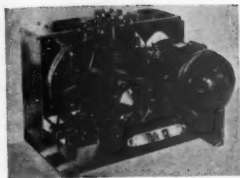
#### The Torry-Hall Freezer

"The *Northern Wave* freezers differed in some important respects from the experimental Torry model. As already mentioned, the freezer was a six-compartment model and thus it economized on jacks and other equipment and was more compact. The seam-welded, embossed evaporator plates were retained, but these were fed through their hinge members from rotating glands sealed with synthetic rubber "O" rings and positioned directly in the manifolds," said the authors.

"Since refrigerant at  $-40^{\circ}\text{F}$ . is required for the quick-freezing process there is no separate problem in providing refrigeration for a cold store at  $-20^{\circ}\text{F}$ . Indeed, it might be feasible to use a secondary refrigerant, thus simplifying the arrangement of the grids and avoiding any possibility of static head effects while at the same time reducing the expensive charge of refrigerant and the potential loss of refrigerant through leaks in the grids. If a low pressure surge drum is provided in conjunction with a forced circulation system for the freezers, a cooling coil for secondary refrigerant might be accommodated therein."

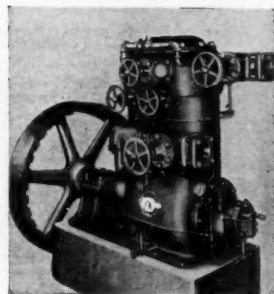
The authors dealt in detail with hot gas defrosting, the liquid primary refrigerant pump, the liquid level control and the modified refrigerant circuit aboard the *Northern Wave*.





## COMMERCIAL AND INDUSTRIAL SECTION

### Manufacturers' and distributors' news



**L. Sterne & Co. Ltd.** have purchased a new building at 36-38 Peckham Road, S.E.5, and are proposing to move their London office and also their service depot and stores at Blackfriars into the building on January 14. Thereafter Palace Chambers and Blackfriars will no longer be used by **L. Sterne & Co.** The new telephone number will be Rodney 6300 (6 lines), and in addition they have arranged an emergency service number, nights and week-ends only—City 2948.

Final ordinary dividend of **R. A. Lister Co. Ltd.**, manufacturers of diesel and dairy appliances, etc., is 7½ per cent., making 10 per cent. for the year ended September 30 (same for 1955-6). Group net profit was £475,541 against £482,727, after tax of £623,097 (£566,586) and minority interests of £398 (£763) and after crediting transfer from tax equalization account of £19,900 (£15,050). Subsidiaries retained £35,048 (£117,465), leaving net profit of the parent company at £440,493 (£365,262).

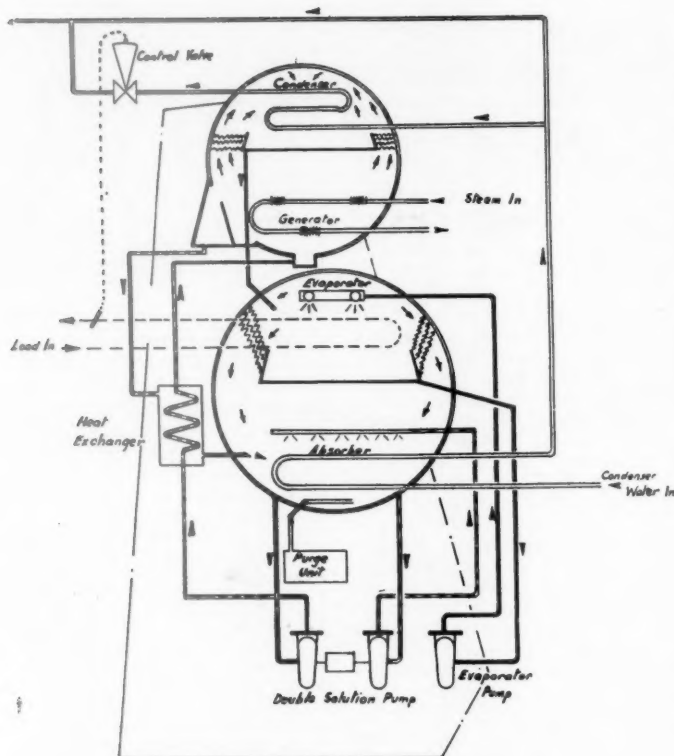
The fifty-fifth annual general meeting of **Heenan Group Ltd.**, was held at Worcester Engineering Works Shrub Hill, Worcester, last month. Mr. Charles L. Hill, the chairman, presided. The group net profit, before taxation, the chairman disclosed was £496,062 compared with £505,900 last year. Taxation took £274,199, against £282,369, and, after deducting outside shareholders' minority interest of £18, the net profit of the group was £221,845, which compared with £223,509 in 1956. The industrial cooler section recorded a marked increase in orders, including nearly 200 air and oil coolers for a hydro-electric plant in the U.S.A. The standard range of water coolers continued to meet

a wide demand and sales of the Heenan-Marley cooling towers were well up on last year, said Mr. Hill. Their efficiency and simplicity of installation and maintenance were fast establishing this new type of construction for a wide range of applications. During the year, double-flow cooling towers had been added to the Heenan-Marley range. **IWEL Engineering Ltd.** (formerly known as Industrial Waste Eliminators Ltd.) had a reasonable year, although trading conditions for its abattoir and bacon factory equipment in the home market continued to be difficult. Towards the end of the year, however, several substantial overseas contracts were obtained from the Government of the Sudan Republic and from the Crown Agents acting for the Government of Northern Nigeria, with the result that the balance of orders at the end of the year was nearly 50 per cent. greater than at the beginning. Several new solvent plants for animal by-products were brought into operation during the year for clients in the United Kingdom and others were in course of construction. Additional applications of this subsidiary's chemical process were being developed and would result in extending its existing field.

In a well-illustrated brochure the range of the **U.D. Engineering Co. Ltd.**'s industrial refrigeration activities is described. Various types of machinery are depicted and mentioned in this booklet which also devotes some of its pages to the factory and to different UDEC installations. Copies are available from **U.D. Engineering Co. Ltd.**, Abbey Works, Cumberland Avenue, Park Royal, London, N.W.10.

The **Carrier Engineering Co. Ltd.**, recently put on in the West End of

London a most graphic exhibition of their "Weathermaster" air-conditioning system and of their automatic absorption type refrigerating machine. Architects, consulting engineers and members of the air-conditioning industry found much to interest them at the Mayfairia Rooms. Some photographic "sets" had been expertly arranged. Typical of these was one wall of an office building with a room air-conditioner installed; outside the "window" was a blown-up view of the City of London and the effect was extremely realistic. Three-foot models of office blocks showed how the conduit system of air-conditioning is installed. These models revolved on turntables and by utilizing different, coloured electric bulbs in the rooms the effect of the heat load of the sun was cleverly illustrated. Special interest was taken by our representative in the automatic, absorption machine, shown diagrammatically here, which operates according to the following principles. The load water which is to be cooled is pumped through the tubes of the evaporator and in its passage through them is reduced in temperature some 7° to 10° F. depending on the number of water passes and quantity involved. The cooling is done mainly by the evaporation of water which is sprayed over the outside of the tubes by the primary chilled water pump. This pump, integral with the machine, continuously circulates this water which is the refrigerant of the machine. Since water has a very high latent heat value only a small part of that circulated by the evaporator pump evaporates and passes through the eliminator banks which arrest droplets and splash. This flow of water vapour develops because the vapour pressure in the absorber section is sufficiently low



to satisfy the modest pressure difference necessary to establish flow. The low vapour pressure is maintained by continuously spraying lithium bromide salt solution at a suitable concentration, and temperature in the absorber. This spray is maintained by one half of the double solution pump. As the solution absorbs the water vapour it needs to be re-concentrated and therefore part of it is pumped to the generator shell where, by heating, vapour is driven off and the power to absorb is restored. In this condition the solution returns to the absorber. The water vapour condensed in the upper shell is returned as a liquid to the evaporator replacing the evaporated quantity previously absorbed. Since neither water nor lithium bromide solution is added or removed from the machine during operation, the cycle is continuous and under steady load conditions balanced. In absorbing the water vapour the solution becomes hot and to remove this heat

the condensing water first passes through the absorber and then part of it passes through the condenser. The amount of cooling done depends on the capacity of the absorber to deal with water vapour and this is regulated by altering the concentration of the lithium bromide solution by controlling the amount of re-concentration in the generator condenser section. As the load drops and the chilled water temperature tends to fall the flow of water through the condenser is automatically restricted causing the concentration of the solution returning to the absorber to be limited. The absorbing capacity is thus matched to the load existing at the time. A continuously operating purge ensures that the machine is kept free from non-condensables in particular air. Safety controls protect the machine from damage.

The capacitor department of the General Electric Company in the

United States has recently expanded its line of rectangular base "Pyranol" capacitors to meet the growing needs of the American air-conditioning industry. New, higher ratings have been developed with a minimum increase in capacitor height and no increase in base dimensions. These higher ratings are for single phase, central air-conditioning equipment. Typical ratings for the new large base rectangular capacitors are 30, 35 and 40 microfarads at 440 volts. The base dimensions are  $4\frac{1}{8}$  in. X  $2\frac{1}{2}$  in., with heights up to 8 in. New ratings for small base rectangulars are 20 microfarads, 440 volts and 30 and 35 microfarads, 370 volts. Base dimensions are  $2\frac{1}{4}$  in. X  $2\frac{1}{8}$  in., with heights up to 8 in. "Pyranol" capacitors are designed to improve power factor while utilizing minimum space.

\* \* \*

Foxboro-Yoxall's new factory at Redhill, Surrey, is now nearing completion. On the 58-acre site just north of Redhill Station, the factory block itself is finished and has been in production for some weeks. The new factory, besides providing a greatly increased floor area, is designed to accommodate the very latest production techniques evolved from the company's many years instrument manufacturing experience in England and America.

The move from the three existing factories at Kidbrooke, Wandsworth and Merton is proceeding smoothly and already the benefits of the new factory are being reflected in the over-all production figures.

\* \* \*

When Hereford Co-operative Society decided to convert their butchery department in Widemarsh Street to a self-service store they re-equipped with Prestcold cabinets supplied by the Hereford branch of Refrigeration (Western) Ltd. whose headquarters are at Shrewsbury. The equipment, comprising three wide model 6-ft. Parade counters, one 8-ft.-wide model Parade counter and a Farmoor sales case, blends pleasantly with the imaginative decor.

An international products division, with world-wide representation, has been formed by **Thermotank Ltd.**, Helen Street, Glasgow, to handle the sales and distribution to the trade of various products concerned with air conditioning, heating and ventilating. The products handled by the new organization will not be confined only to those manufactured by the parent company, but will include eventually items produced by firms in many overseas countries. The division will be truly international, as it will sell to the world the products of the world. Branch offices have been opened at all the overseas offices of **Thermotank Ltd.**, and one of the first effects will be the availability throughout the world of all **Thermotank** punkah louvres and air distributors. Among the reasons for forming the division must be counted the possibility of the European common market, and the greater opportunities which would then exist for the exchange of products throughout the Continent.

\* \* \*

**J. Oliver Leech Ltd.**, Lec distributors in Belfast, have sold two Lec models to the Ministry of Finance for Northern Ireland to be installed at Stormont House for the use of the Prime Minister and his wife, Lord and Lady Brookborough. The models are the S.13 and the freezer, C.F.25.

\* \* \*

Something new in Christmas parties was staged by **Prestcold** last month at their Sceptre House, Regent Street, London, showrooms. The occasion was a special one and was accompanied by many unusual features. It was in addition attended by several very unusual people! First in place of honour should be mentioned **Johanne Bendtsen** and **Kaj Sivertsen**. Both are Eskimos

and to pay this special visit they travelled all the way from their homes in North-West Greenland. Also present was Mr. Peter Scott, the well-known ornithologist, who knows the Arctic well, and to add some local colour for both him and the Eskimo visitors were two penguins from Chessington Zoo. The whole occasion was made an opportunity for a children's party for boys and girls from Dr. Barnardo's Homes; they were given presents from a Christmas tree by **Johanne** and **Kaj** and they sang Christmas carols to entertain the guests. Both the Eskimos studied the **Prestcold** refrigerators with great interest and **Kaj** has taken a **Prestcold** home with him. He said before leaving that it would be put to very good use; there may, however, be one

or two unusual foodstuffs stored inside it as his "menus" at home include bear-, seal- and whale-meat. Thus, "selling a refrigerator to an Eskimo"—the height of salesmanship—was something of an achievement. Both the Eskimos flew to London in an Icelandic Airlines plane and an additional entertainment for the guests at the party was the provision of a mysterious new cocktail called "Air-leader"; the visitor who guessed the ingredients correctly was presented by Icelandic Airlines with a free flight ticket. Before returning home **Johanne** appeared in the B.B.C. Television programme "What's my Line?" whilst **Kaj**, who is able to speak English, appeared in the B.B.C. sound radio feature "In Town Tonight."



Left to right: **Johanne**, **Kaj**, and **Peter Scott**.

#### STERNE'S HOLD SERVICE SCHOOL

THE Liverpool office of **L. Sterne & Co. Ltd.**, at 37, Duke Street, last month held a two-day service school for engineers from their approved service dealers in the north-west. The accompanying photograph shows the service-men

prepared for the first session. The curriculum dealt entirely with hermetic application and repair as the **Tecumseh** range of hermetic models is now very wide indeed for **Sterne** dealers to handle.

The organizers consider that this service school

did a great deal of good and they hope to have another one in the New Year.

At the new Sterne extensions at Newcastle and

at the new office in Hull, which is just opening, service schools will be held this year for service engineers handling their products in these areas.

Sterne's  
service  
school  
at  
Liverpool.



### THE CARRIAGE OF BANANAS

(Continued from page 43)

of 24 hours for a change in temperature to have an appreciable effect on respiration. On this assumption and using the figures for respiration rates obtained separately, it is suggested that a rate of heat production of 290 B.t.u. per hour per ton at 18° C. can be assumed as constant throughout a cooling run.

Table (I) gives figures for the sensible heat transfer as deduced from the cooling curves. The sensible heat transfer rate is given for four air speeds and is expressed as B.t.u. per ton per °F. difference in temperature between air and mean fruit flesh. This is the heat quantity involved in changing the fruit temperature (assuming a specific heat of 0.88) and is not corrected for the fruit respiration heat or for the latent heat of evaporation. From the observed weight losses the latent heat quantities were approximately 1,000, 680, and 500 B.t.u. per hour per ton for the unwrapped, straw wrapped and polythene wrapped respectively. The observed weight loss from the green fruit is

higher than that observed by A. J. M. Smith but this may be because the fruits were comparatively fresh and the weight loss is mainly from the peel and from the stem. It is, however, this figure which has to be considered when estimating the cooling requirements.

TABLE I  
(B.T.U./TON/HR./°F. TD)

Air speed f.p.m.	5	10	20	30
Polythene wrapped	394	415	435	445
Straw wrapped	443	620	810	965
Unwrapped	786	1,180	1,760	2,210

The work described in this paper was carried out as part of the programme of the Food Investigation Organization of the Department of Scientific and Industrial Research.

(Crown Copyright Reserved).

#### Reference

SMITH, A. J. M. "Evaporation from Foodstuffs." Food Investigation Board Annual Report 1932. Page 117.

JANUARY 1958



## Low Temperature Recovery of Olefins

By L. B. BAKER,  
B.Sc., M.Sc. \*

THE enormous post-war growth of the chemical and petro-chemical industries has led to a demand for millions of tons per year of certain basic chemicals. The most important of these are acetylene and the olefins, particularly ethylene and propylene. While acetylene is produced in large amounts in the United States of America and Germany, in Europe generally the lack of a suitable combination of feedstocks and processes has limited the growth of production. The olefins, however, may be readily produced by cracking various petroleum fractions. It is the purpose of this paper to consider the methods employed in recovering ethylene and propylene in a number of plants, in which more than 2,000 tons per day of ethylene are produced. Other light hydrocarbons are simultaneously recovered in correspondingly large quantities.

The materials from which olefins can be obtained by cracking include almost the whole range of petroleum fractions. In the United States the light paraffin hydrocarbons in natural gas provide an excellent feedstock. In Europe, however, ethane and propane from this source are not available, and the principal raw materials are the lighter petroleum fractions and particularly those boiling between approximately 86° F. and 392° F. In some instances, refinery gas or coke oven gas provide useful sources of ethylene itself and of light paraffins for further cracking. However the quantities available are not sufficient, except perhaps in the largest plants, to permit large-scale production of olefins on a sound economic basis, although they have considerable supplementary value.

TABLE I  
LOW TEMPERATURE RECOVERY UNIT FEED  
TYPICAL GAS COMPOSITIONS

	From ethane cracking (Volume per cent.)	From propane cracking (Volume per cent.)	From light gasoline cracking (Volume per cent.)	From heavy naphtha cracking (Volume per cent.)
H <sub>2</sub>	33.9	14.1	9.9	7.3
CH <sub>4</sub>	5.8	35.8	27.6	26.3
C <sub>2</sub> H <sub>6</sub>	0.2	0.3	0.1	0.1
C <sub>3</sub> H <sub>8</sub>	33.0	28.6	20.3	23.5
C <sub>4</sub> H <sub>10</sub>	25.7	4.9	7.7	8.8
C <sub>5</sub> H <sub>12</sub>	0.5	7.5	13.1	15.0
C <sub>6</sub> H <sub>14</sub>	0.2	5.4	1.7	1.3
C <sub>7</sub> H <sub>16</sub>	—	0.7	1.6	1.6
C <sub>8</sub> H <sub>18</sub>	0.4	0.3	5.6	6.1
C <sub>9</sub> H <sub>20</sub>	—	0.2	0.2	0.2
C <sub>10</sub> + C <sub>11</sub> +	0.3	2.2	12.2	9.8
	100.0	100.0	100.0	100.0

\* E. B. Badger & Sons, Limited, London, W.C.1. From a paper presented at a joint meeting of The Low Temperature Group of the Physical Society and The Institute of Chemical Engineers held in London on November 26, 1957.

The cracked gases are normally obtained at substantially atmospheric conditions after the customary heat recovery and quenching operations. They are freed of all but traces of very heavy hydrocarbons and contain little material boiling above 392° F. The ethylene output of commercial plants varies between 20 and 440 tons per day. Other light hydrocarbons are present in corresponding amounts. Typical compositions of the gases entering the recovery sections of ethylene plants are shown in table I. This table shows wide variations in gas composition according to the raw material. A typical plant might combine once-through cracking of light gasoline with recycle cracking of ethane.

### Products

The principal product to be recovered from these light hydrocarbon mixtures is ethylene for use in the manufacture of ethylene oxide, polythene, ethyl alcohol, and a wide range of other chemicals. The purity required varies from 80 to 85 per cent. for ethylene oxide production by the chlorhydrin process, to above 99.5 per cent. for some polythene manufacturing processes. Frequently, rigid limits are set for impurities such as carbon monoxide, but since these requirements are largely met by suitable chemical pretreatments of the feed gas, consideration of them lies outside the scope of this paper. An important exception however is acetylene, the removal of which affects to some degree the processing scheme adopted for the recovery plant. The amount of acetylene tolerable in the ethylene product for a number of processes ranges from 5 to 50 p.p.m. The methods adopted to reach these low levels are discussed later in the paper.

The next important product to be recovered is propylene which may be used for *iso*-propyl alcohol manufacture or for polymerization to dodecylene for the production of detergent alkylate. For a number of purposes the purity required is relatively low, approximately 90 to 95 per cent., with less emphasis on the amounts of impurities such as methyl acetylene that can be tolerated.

Butadiene is produced in commercially important quantities when cracking light liquid hydrocarbons and may be recovered by solvent extraction. However, the low temperature units discussed here normally produce a mixed C<sub>4</sub> hydrocarbon product which is used either for fuel or further processing.

The relative quantities of olefins and di-olefins produced in a typical ethylene plant processing light gasoline are given in table II.

TABLE II  
PRODUCTION OF OLEFIN AND DI-OLEFIN FROM  
TYPICAL PLANT

	Production (tons/year)
Ethylene	30,000
Propylene	32,000
Butadiene	4,300
Butylenes	16,100

### Processing Scheme

In Western Europe, the recent trend has been for large olefin recovery plants to be closely integrated with the plants converting the olefins into various chemical products and intermediates such as polythene, ethyl alcohol, *iso*-propyl alcohol, and propylene polymers. These plants require uninterrupted olefin supplies of constant quality, and to meet this need the olefin recovery plant must be capable of continuous operation for long periods or adequate storage capacity for the olefins must be provided to cover temporary

stoppages. While liquid propylene may be stored at atmospheric temperatures under moderate pressures, this cannot be done with ethylene. In one instance in the United States a large underground reservoir provides a means of bulk storage of ethylene gas, but since such reservoirs are not usually available, suitable storage can only be provided by refrigerated vessels. A low temperature storage system for ethylene of sufficient capacity to meet several days' demand is very costly. For this reason, the olefin recovery plants described in this paper are designed to ensure stable operation over very long periods without periodic shutdowns for cleaning and maintenance.

The general design of the low temperature recovery systems discussed in this paper is derived from petroleum refinery practice. Here the demand has been for rugged reliable units fully capable of handling variations in feed quantity or compositions without loss of production. In such olefin plants continued runs of over two years have been obtained.

The processing sequence for a low temperature separation unit is as follows:—

Compression  
Gas treating  
Drying  
Fractionation.

#### Compression

The first step is the compression of the feed-gas to approximately 550 lb./sq. in. abs. Three or four stages of compression may be required according to the gas composition. The pyrolysis gases, particularly from distillate cracking, contain appreciable quantities of highly unsaturated compounds. To minimize fouling of the compressors and their associated piping by polymerization of the unsaturated materials, a temperature limit of approximately 225° F. is imposed. This is met by interstage cooling of the gases and limitation of the compression ratio per stage. In some cases oil scrubbing after the first stage of compression may be desirable to remove unsaturated compounds from the gases.

The compressors may be reciprocating or centrifugal. In small plants centrifugal machines cannot be employed owing to the need to deliver a certain minimum volume of gas from the last wheel of the compressor. For large installations economic considerations often dictate the choice. Comparable costs for a United States installation have been published<sup>2</sup> and it has been pointed out that utility costs and availability are the deciding factors. The provision of spare capacity may have considerable bearing on the selections of the compressor type. A number of compressors operating in parallel are normally provided to take care of fluctuations in the gas flow and to allow for routine maintenance of the units.

During compression considerable quantities of water and heavier hydrocarbons are condensed. Condensed light hydrocarbons may be conveniently recovered by flashing the liquids back to the preceding compression stage. In gases from distillate cracking, the quantities of liquids are sufficient to justify the provision of a separate light hydrocarbon stripper to recover ethylene and enable the liquids to pass directly to the depropanizer. The gas from the last stage of compression is cooled to the minimum permissible temperature limited by hydrate formation with water and propylene refrigerant.

#### Chemical treatment

Pyrolysis gases will normally contain traces of carbon dioxide. Hydrogen sulphide will also be present when the feed contains sulphur. Both are readily removed from the compressed gases by washing with caustic soda solutions.

Two-stage washing is desirable both to reduce caustic consumption and to reach low levels of carbon dioxide in the ethylene product. Amine treatment has also been used for hydrogen sulphide removal in some large recovery plants.

#### Drying

Drying of the feed gases before they are processed in the low temperature recovery unit is essential. Light hydrocarbons form solid hydrates under well established conditions of pressure and temperature<sup>1,2</sup> and unless suitable precautions are taken to eliminate water the hydrates will plug the exchangers and fractionating columns. For a typical cracked gas the minimum temperature to which the mixture can be cooled at 550 lb./sq. in. abs. without hydrate formation is approximately 60 to 70° F. Cooling to this temperature before the dehydrators not only permits the use of smaller vessels but also makes it possible to dry to a lower dewpoint.<sup>3</sup>

A dewpoint of —100° F. is adequate for continued operation even in plants where the operating temperatures are as low as —150° F. The reason for this lies in the fact that the traces of water remaining after the drying operation are distributed amongst the various low temperature streams in such a manner that hydrate forming conditions are not encountered under normal operation. Methanol injection facilities may be provided to reduce operating difficulties if water accidentally enters the low temperature system, but are not otherwise required.

The customary method of drying the compressed gas is by fixed beds of solid desiccant. A wide variety of suitable desiccants is available, and the selection is largely a matter of economics. The desiccants require periodic regeneration, the frequency depending on the amount of water to be removed and the size of the bed. Normally two or three vessels are used, one vessel being regenerated while the others are in service. The desiccant is conveniently regenerated by heating the bed to about 400° F. with hot dried residue gas from the recovery system.

#### Fractionation

The dried gases are cooled in a succession of heat exchangers before passing to the first column, the demethanizer, in the fractionation section. The coolants used are product streams leaving the recovery unit as well as propylene and ethylene refrigerants.

In the demethanizer, hydrogen and methane together with inert gases such as carbon monoxide are removed from the feed-gas mixture. This column normally operates at pressures from 400 to 500 lb./sq. in. abs. Lower pressures are technically feasible but require considerably lower refrigerant temperatures to obtain sufficient partial condensation of the column overhead. While a methane refrigeration cycle is adequate for this purpose, it leads to considerable complication of the plant and a loss in flexibility and is therefore considered undesirable. Higher pressures are not practical, since for many feed-gas compositions the column base temperature approaches the critical value, at which the column becomes inoperable. In addition there is little gain as regards ethylene loss in the residue gas in operating the column at above 450 lb./sq. in. abs. The temperature in the demethanizer reflux drum is limited by the ethylene refrigerant used which has an atmospheric boiling point of approximately —150° F. Practical condensing temperatures for the demethanizer overhead stream are thus maintained in the range of —130° to —140° F.

(to be continued)

## INSULATION OF PIPEWORK



Fig. 1 Fig. 4



Fig. 2 Fig. 5



Fig. 3 Fig. 6



The rising cost of fuel and the demand for more economic operation of heating and cooling plants underline the need for efficient thermal insulation. In the past, the installation of lagging was frequently neglected on the grounds

that it is too expensive or too difficult to apply and remove. That this is no longer true is shown in the accompanying illustrations. Starting with a length of bare piping incorporating a standard flanged valve (fig. 1), the operator

first applies pre-fabricated 2-inch thick half-round cork sections (fig. 2). To ensure a snug fit the mating faces between cork and pipe and between the cork sections themselves are provided with a layer of Densoset, which is a non-

setting petroleum-based compound containing siliceous fillers.

\* \* \*

Densoset is waterproof and thus forms an impervious seal which protects the pipe against corrosion. Its paste-like consistency also serves to hold the cork sections temporarily in position. To secure them and to prevent the cork material from absorbing moisture, the assembly is wrapped in Densyl tape (fig. 3), which is made of a highly absorbent, tough cotton fabric, impregnated and coated on both sides with a material similar to Densoset. The tape can be applied in straight sections or spiralled on to long straight runs. In either case, a short overlap enables the soft coating to be pressed together to form a watertight joint. The valve itself, which would be difficult to protect with rigid lagging, is covered with Densofil, which is built up to the diameter of the lagged pipes to either side of the valve. This putty-like material is similar to Densoset, but contains a large proportion of granulated cork as filler to give it more body. It is readily moulded to any shape, is self-supporting and non-setting. With the space around the valve body packed to the diameter of the lagged pipe, short sections of cork lagging of larger diameter are applied over the valve, using Densoset once more to seal all mating surfaces. At the top of the larger cork sections, a groove in both halves accommodates the valve spindle. To keep the halves securely in position, they are quickly tied with galvanized iron wire (fig. 4). To complete the job, the valve section is also wrapped with Densyl tape, the sides of which are cut (fig. 5) to allow them to be turned over the end faces of the cork sections. The gussets are smoothed down over the ends so that they overlap from the top downwards on either side, thus eliminating the possibility of moisture seeping into the lagging. On the completed job (fig. 6) all joints are smoothed down and are practically invisible. In locations where passing persons may touch the lagging, it can be painted with emulsion paint to give a completely dry and non-smear surface. The Denso materials (made by

Winn & Coales Ltd., Denso House, Chapel Road, London, S.E.27) are suitable for a wide range of temperatures. Densoset and Densofil, for instance, are unaffected by temperatures ranging from  $-50^{\circ}\text{F.}$  to  $+90^{\circ}\text{F.}$ , and are thus equally useful for heated or refrigerated plant.

\* \* \*

**Winston Electronics Ltd.**, Shepperton, Middlesex, have been appointed sole United Kingdom agents for a number of industrial electronic control instruments manufactured by Beckman Instruments, G.m.b.H., Munich, Germany, and Beckman Instruments, Inc., Fullerton, California, U.S.A. The instruments have applications to gas and air compressors, coils and valves, refrigeration, the manufacture of electronic components, transformer casings, glass-metal seals, the television, valve and radar industries and manufacturers of electronic equipment, and in the engineering, gas and fluid handling and transport, aircraft and metallurgical industries. Wherever vacuum drying and packing, and vacuum furnaces, valves and pumps are used are other applications. The equipments are of concern to the chemical, food, heating, oil, liquid transport, drying and refrigerating plants and in the laboratory.

\* \* \*

**Monsanto Chemicals Ltd.** is developing the pattern of its internal organisation to meet the requirements of the continued growth of its business and its current programme of expansion. Operations are now divided between two new divisions, respectively called the chemicals division and plastics division. This decentralization will increase the efficiency of customer and after-sales service and enable still greater attention to be given to production, research and technical matters. Mr. D. R. Mackie has been appointed director of the chemicals division in addition to his duties as managing director. Dr. J. W. Barrett has been appointed director of the plastics division in addition to his duties as technical director. The directors of the chemicals and plastics divisions will carry over-all responsibility for all operations in their respective divisions, including the co-ordination of production and engineering, sales,

research and personnel. The main products handled by the chemicals division will be heavy and fine chemicals. The main products handled by the plastics division will be plastics, rubber chemicals, oil additives and other technical chemicals.

\* \* \*

A revolutionary new British material, Stelvetite, plastic-coated steel sheet, which will have countless applications in industry, has just been launched by the steel company, **John Summers & Sons Ltd.**, of Shotton, Chester. The most remarkable feature of Stelvetite is that it can be worked and treated as ordinary steel sheet, while its outer surface retains all the characteristics of P.V.C. plastic, produced in a varied range of colours and embossed patterns. The outer plastic surface is a permanent, complete finish in itself, being extremely easy to clean. This is steel with a "new look" and a "new touch," offering a host of possibilities in the manufacture of many types of domestic and industrial items, combining the strength and durability of steel with the finish and texture of plastic. A particular virtue from the manufacturer's point of view is that the use of Stelvetite eliminates the need for surface finishing treatments. From the cost aspect, Stelvetite is a very economical proposition, being cheaper than stainless steel. Developed exclusively by John Summers & Sons Ltd., in conjunction with B.X. Plastics Ltd., Stelvetite is strip mill cold reduced steel with a specially formulated Velbex P.V.C. coating. The reverse side of the sheet can be either a bonderized steel or electro-zinc-coated surface. It can be bent, formed, seamed, deep drawn, joined and welded without damaging the coating; it is warm and pleasant to the touch, has excellent electrical insulating properties, and is highly resistant to acids, alkalis, greases, detergents, weather, humidity, and to abrasion. It does not support combustion, and is stable at higher temperatures than P.V.C. alone.

\* \* \*

**Keith Blackman Ltd.** announce the inauguration of their new, up-to-the-minute acoustic laboratory at the company's head office and works at Tottenham, London, N.17.





## SELF-SERVICE IN THE MEAT TRADE

The attitude of the Scottish meat trade to refrigeration and self-service has been outlined in a survey presented by the Scottish Meat Trade Federation to the under-secretary of State for Scotland. In this the Federation states :

"Now legislation has been introduced to improve the conditions under which meat is sold, and we can have no quarrel with that. It is, however, obvious to anyone who has served his apprenticeship in the butcher trade that there are two grave omissions in the Food and Drugs Act. In the first place, we find that anyone with sufficient capital can open a butcher's shop, and work it without skilled labour. This type of shop is doomed to failure. But before this point is reached, it is a potential danger to the health of the public, as the owner is without knowledge of how to handle meat properly, and there is a danger of tainted meat being sold over the counter, or being used for manufacturing purposes.

"Secondly, to our mind the most dangerous method of retailing meat is prepacked, from a refrigerated counter, by someone who does not know one cut from another.

"There is a growing tendency for meat to be sold

as a side-line from departmental stores and bazaars, where you find a pets corner, greengroceries, garden plants, and perhaps a perfumery counter in close proximity. The refrigerator counter is now finding its way into the small corner shop which handles everything from a needle to an anchor. Indeed, we are all familiar with the 'mixed business,' where cheese, soap, morning rolls, bread, paraffin and potatoes are handled by the proprietor and assistant. The Food and Drugs Act will deal with this aspect of the matter up to a point but must leave much to be desired.

"The butchery trade was among the first to use refrigeration, and over many years of experience has learned its limitations and it has been brought to our notice time and again by our customers who have refrigerators and they are under impression that once an article is put in a refrigerator, you can forget about it. With this experience there is a grave danger that people who use refrigerated counters will not have sufficient experience of the meat they handle to know whether it is likely to go bad, or otherwise, much less to make the best use of refrigeration which after all, is only an aid, not a remedy.

"A time-served butcher watches his stocks and can make a fairly accurate estimate as to whether the meat sold to-day will be fit for consumption to-morrow. In the light of this experience of fluctuating public demand, he utilizes surplus meat for manufacturing purposes long before it reaches the doubtful stage, and is able to maintain the appropriate stock in the best condition.

"This, of course, is not a practical proposition

for the other retailers of butcher meat, but is a system whereby the public is protected by the experience and the knowledge handed down from generation to generation.

"The only safeguard to the public, therefore, is to ensure that the person actually handling the meat in question, or the person in charge of the sale of it, has the necessary training and experience, particularly when so many of the new developments in salesmanship tend to cover up the lack of

this knowledge, to the disadvantage of the public.

"Some system of compulsory registration of persons seems more necessary than ever. In view of the success of the technical education classes initiated over a number of years by the Scottish Federation, with the co-operation of the Scottish Education Department and various other education authorities, there is now an established standard of training for both master butchers and craftsmen."

## "Clean as a New Pin"



A butcher's shop which is as bright as the proverbial new pin is now to be seen in Chesterfield Road, Ashford, Middlesex. Just how far the butchery business has developed since the old days of sawdust and wooden blocks is demonstrated to a remarkable degree by this new shop. From the outside it attracts the eye immediately with its light-painted front and gay and colourful awnings. Inside, the effect is maintained and, if possible, enhanced, for there

Produce is attractively stored on view in a Prestcold display counter. The shop also has a frozen food sales case (extreme left).



**SHOP REFRIGERATION NEWS**

*(Continued from page 72)*

are tiled walls and a floor laid out in a chequer-board design of black and white.

To the immediate impression of freshness and cleanliness there is added practical evidence in both these directions as a result of the presence of a most comprehensive range of refrigerated fittings, supplied by the London branch of Prestcold Refrigeration. Displaying goods attractively while providing safe and hygienic storage is a 6 ft. display counter and there is also an OFC.353 frozen food sales case. For main meat storage there is a "butchers' freezer" of 165 c.ft. capacity, operating at 15° to 20° F. It is cooled by one of the new Prestcold low temperature unit coolers and a Super Pres-metic condensing unit incorporating automatic defrosting equipment.

## Refrigerated Window

A sparkling display of fresh meat is offered to prospective shoppers and casual passers-by, and is kept in perfect condition by means of a refrigerated window. The shop is comparatively small in size, but is the more noteworthy for that reason as it forms an outstanding example of the way in which an enterprising butcher can provide for his customers a really attractive shop from which to make purchases, while at the same time ensuring that the latter are always tempting and in first-class condition thanks to a really comprehensive range of refrigerating equipment.



An attractive view of one corner in the new Premier supermarket at Hounslow West. The case in the foreground is by Frigidaire and is the first installation of their new-style, island-sited, display case in the Manhattan range.

## COLD STORAGE OFFICERS

At the annual general meeting of the South of England and South Wales Cold Storage Association, Mr. F. H. Hunt, of Bristol, was re-elected chairman, and Mr. R. H. R. Lloyd, of Cardiff, was reappointed secretary and treasurer.

Mr. Hunt joined the Avon Cold Store, Bristol, in 1916 and therefore has been in the cold storage industry over 40 years. He has been a council member of the National Federation for a great many years. He is also a member of the Institute of Refrigeration, and vice-chairman of Bristol Industries Limited who own various cold stores in the west country.



**Mr. F. H.  
Hunt.**



"Refrigeration Corner" at the Smithfield Show at Earl's Court, London, has become a Mecca for retailers wishing to inspect a wide range of refrigerated display counters and other products of this industry. Last month at this event, Frigidaire Division of General Motors exhibited a full range of standard frozen food cabinets and conservators, a reach-in refrigerator, a bottled-beverage cooler, three household refrigerators (all these models were operating), and six types of condensing unit. Additional special equipment included a 150 c.ft. chill room, an open-top display case, a farm freezer, a display counter, a Manhattan self-service island case, a self-service case with canopy and a "Cooltop" unit.

## The Smithfield Show

*"Shop Window" for Retail Cabinets*



Hussmann British Refrigeration Limited displayed a wide range of MD cabinets, designed to be sited against the wall, in a counter run or in island site positions. The special plastic metal laminate coloured fronts were shown in red, blue, green, brick, cream and white, the cabinet in the foreground being red. In addition, Hussmann exhibited the new OSD cabinet positioned in a window, also in a special "carcase" having the outline of the MD range. The cabinets were filled with fresh meat, both pre-packed and unwrapped and the OSD range were dressed with cooked meats by famous makers. The MD-L frozen food cabinet was filled with a wide variety of frozen food.



# BUYERS' GUIDE

**Britain's Leading  
Air Treatment  
Engineers**

## AIR CONTROL

**INSTALLATIONS LIMITED**

Ruislip, Middlesex  
Ruislip 4066

London, Birmingham, Manchester  
Newcastle, Glasgow

AIR  
CONDITIONING

\*

FANS

\*

AIR

FILTRATION

\*

DUST

CONTROL

## AIR CONDITIONING

for all applications

### TEMPERATURE LIMITED

Largest producer of Air Conditioning Units  
outside the U.S.A.

**BURLINGTON ROAD · FULHAM**

Phone: **LONDON SW6**  
RENown 5813 p.b.x.

Cables: **TEMTUR LONDON**

**FASTER  
Freezing!**



DESCRIPTIVE LITERATURE AVAILABLE  
ON REQUEST FROM:

*Jackstone Froster Ltd.*

HUTTON ROAD · GRIMSBY  
ENGLAND

THIS SEAL IS  
YOUR GUARANTEE

**SPECIALIST FOR ALL  
INSULATION WORK  
SECTIONAL COLDROOMS  
BUILT-IN COLDROOMS**



**NOTLEY LTD.**  
**NORTH LONDON INSULATION WORKS**  
L.M.S. STATION YARD, THE BROADWAY,  
MILL HILL, N.W.7  
Phone: Mill Hill 1878; 3381

## REFRIGERATED PRODUCE

### FROZEN FISH

**George Tabor, Ltd.**, Imperial House, Pudding Lane,  
London, E.C.3. Phone: Mansion House 8044.  
Wires: "Passport, London." A strong and well-  
established organization for marketing FROZEN FISH  
throughout the U.K. and Europe. Proprietors of  
"NEWBAY" and "TASAM" Salmon and other Frozen  
Fish. Producers of Oysters and Smoked Fish,  
Marinated Herrings and Sprats.

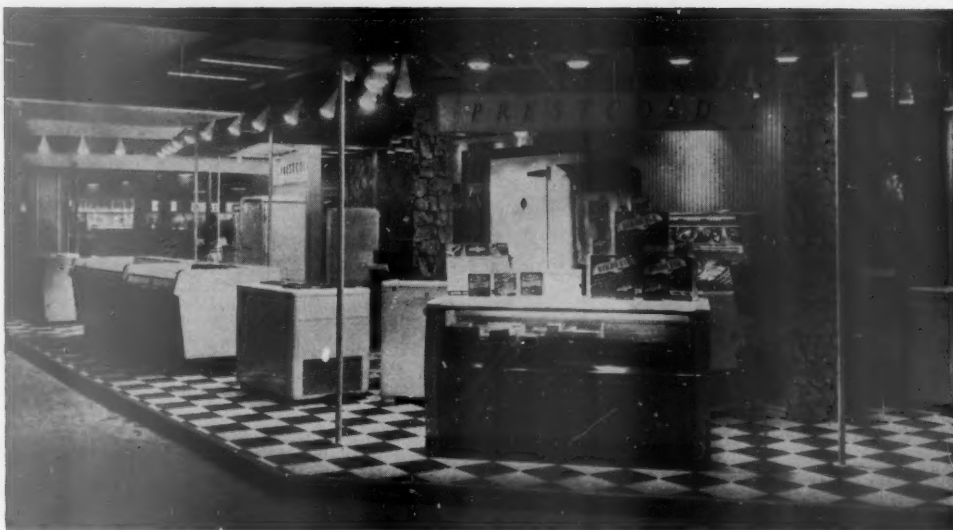
### MEAT

**Thomas Borthwick & Sons Ltd.**, Audrey House,  
Ely Place, and Central Markets, London, and the  
Provinces. Telegrams: "Overdraw, London." Tel.:  
Holborn 5234 (7 lines).

## NELSON AND FLEMING ICE CRUSHERS

FOR ALL PURPOSES UP TO 100 TONS PER HOUR  
**PERTWEE & BACK, LTD.**  
NELSON IRON WORKS, GT. YARMOUTH

## SHOP REFRIGERATION NEWS



The Prestcold Division of The Pressed Steel Co. Ltd. presented a full range of equipment which included three service cabinets—SC141, SC176 and SC285; seven display cases—a Farmoor meat case, a Farmoor frozen food case, a OFC353 Promoter, a three-quarter-vision display case (operated by Prestcold AH20 unit), an 8 ft. Parade case (operated by Prestcold AS200L unit), a 6 ft. Parade meat case (operated by AS75 unit), a 150 lb. butcher's coldroom; three display units—AS25, AS33, and AS50 and three conservators—CC60, CC83 and an Eldwood farm freezer.

The Smithfield Refrigerator Company Limited showed "Rotorflow" refrigerated stallboard and self-service counters and "Cleanlock" sectional cold rooms. A new display case, the "Beauview" attracted considerable attention by its large area of curved glazing which permits a very clear view of the contents. The shape is reminiscent of a roll-top desk. Two other makers of refrigeration plant took stand space, namely, J. & E. Hall Limited and The Lightfoot Refrigeration Co. Ltd. Hall's featured counter-top display units, refrigerated display cabinets, and a selection of refrigeration units from the wide range available. The theme of the Lightfoot stand was "the freezing, storage, transport and display of frozen foods." Various plants and machines for these purposes were exhibited in the form of a Jackstone Froster, plate type freezing unit; a condensing unit with forced draught cooling unit with electric defrosting for storage rooms; a diesel electric refrigerating plant for a refrigerated vehicle; and display counters of various types for the final phase, suitable for retail shops. In addition, there were exhibited an open top counter-type refrigerator for the display of cut and cooked meats and also, double-deck models—one for the display of frozen foods and the other for general purpose display for cut and cooked meats, etc.



Seen  
our latest ?



To the well-known family of Onazote low-temperature insulation materials is now added an interesting lightweight newcomer: POLYZOTE (expanded polystyrene). POLYZOTE, which is being marketed by Expanded Plastics Ltd. is available in boards for low temperature insulation, the following being the principal characteristics of this outstanding new insulating medium:—

**Extremely light in weight**

**Attractive in appearance**

**Odourless**

**Rigid, easily handled and installed**

**Economical in price**

**K factor 0.22 B.T.U's at mean temp. 10°C.**  
(NPL report available)

**Entirely British made**

## **Polyzote** (Regd.) THERMAL INSULATION

Write for data sheet with samples and prices to—

### **EXPANDED PLASTICS LIMITED**

675, Mitcham Road, Croydon, Surrey Telephone: Thornton Heath 3622

Subsidiary of Expanded Rubber Company Limited—a member company of The British Xylonite Group

T.A.10265

## SHOP REFRIGERATION NEWS

## Frigidaire Price Reductions

### Frozen Food Cabinets Cheaper

**S**UBSTANTIAL price reductions on a number of items of commercial refrigeration equipment are announced by Frigidaire Division of General Motors Ltd. The principal changes, which are effective immediately, concern the company's range of frozen food cabinets. Prices of all four standard models in this range have been reduced by an average of 7 per cent.

Also subject to price reduction is the Frigidaire ice cube maker, model IFR-15, and the DX-800 series of display case evaporators.

These price reductions, representing a further stage in Frigidaire's 5-point development programme for commercial refrigeration, have been made possible, despite increased cost of raw materials and labour, by increased volume and manufacturing efficiency.

In making the reductions at this time, the company has also been very conscious of the necessity, urged upon the country by Her Majesty's Government, of keeping prices at their lowest possible level.

Models and price reductions have been made as follows:—

Model	Net Storage Capacity	Old Price	New Price
FROZEN FOOD CABINETS			
JFR-101	(8.3 c.ft.)	£143 10 0	£133 10 0
JFR-100/S	(8.3 c.ft.)	£150 0 0	£140 0 0
JFR-131	(10.8 c.ft.)	£161 0 0	£151 0 0
JFR-131/S	(10.8 c.ft.)	£168 0 0	£158 0 0
ICE CUBE MAKER			
IFR-15	—	£82 10 0	£73 0 0

## Display Cases for Butchers

**C**ARTER Refrigeration and Airconditioning Limited, of 98, Bordesley Green, Birmingham, 9, were delighted with the interest shown in the equipment on their stand (which was the largest ever taken) at the 96th exhibition of the Birmingham Cattle and Poultry Show. On

the stand was displayed a representative range of refrigerating equipment for the butcher. Prominently pictured was the Carter "Open-Vision" self-service, refrigerated counter and the two models shown consisted of a 16 ft. dual temperature, pre-packed meat and frozen food cabinet, and a 12 ft. self-selection model designed for the shop wishing to sell both pre-packed and unwrapped meat.

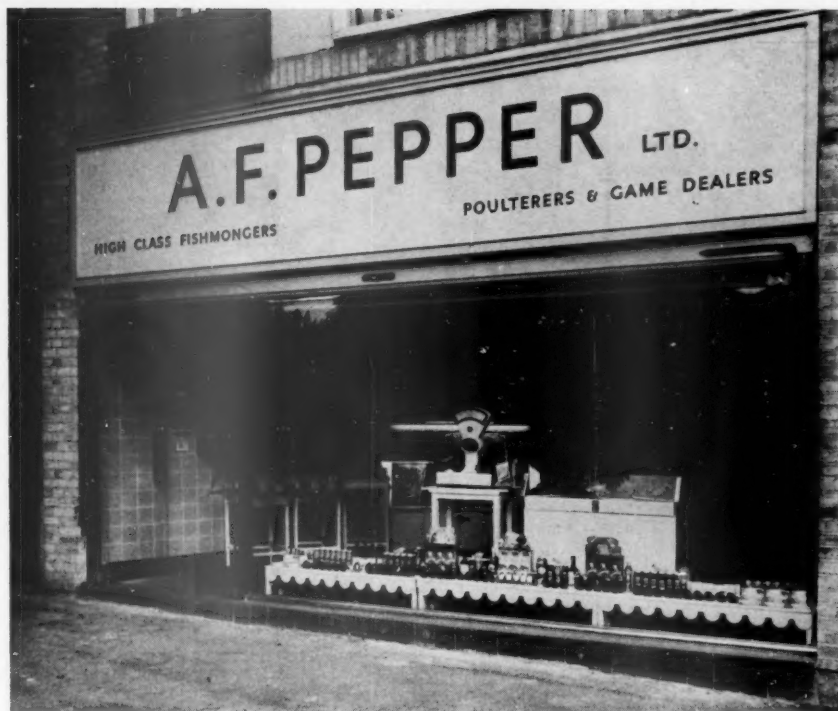
An 8 ft. dual temperature, multi-tier, display



case was also on display stocked with oven-ready turkeys produced by John S. Lintern Ltd.

At the front of the stand were two items of considerable interest to many of the retail butchers who visited the show. The first was a Carter "Open-Vision" refrigerated window display unit, designed to give a wide display of meat with easy access. This unit is mounted on castors for removal from the window when required. The second item consisted of a special pentagon shaped "Open-Top" display counter designed and manufactured at their Bordesley Green factory for the new self-service shop of W. J. Cooper Ltd. of Wolverhampton.





## Refrigeration for the Fishmonger

By Our Special Retail Correspondent

A COLD ROOM behind the shop still is, in the average fishmonger's view, all that is necessary in the way of refrigeration. It took a long time to persuade him that such an installation was necessary.

Of recent years, his peace of mind has been recurrently disturbed first by the craze for displaying fish under temperature-controlled conditions and, sillier still, under cover, then by the introduction of quick-frozen fish, which can be bought in packets in grocers' or fruiterers' or delicatessen shops. And there is all the pre-cooked stuff sold by the same people: fish fingers (or sticks), fish-and-chips, even fish pies. The climax in all this mad caper for novelty and stuntism, as

he puts it, is the dolling up of wet fish in little trays wrapped in cellulose film. It's all pampering and confusing and unsettling the woman shopper who would have been quite content to go on buying all her fish from the slab, in his opinion.

That is a not greatly exaggerated summing up of the average fishmonger's point of view. He is resistant to change, yet resents the competition that makes change desirable. It is, in fact, he, rather than the woman shopper, who has become confused and unsettled. The young housewife welcomes changes and responds to the pampering which saves her time and trouble in the kitchen.

The biggest source of worry is probably the ever-growing and, to the fishmonger's mind, ille-

SHOP REFRIGERATION NEWS

Cabinet for poultry and refrigerated slabs for wet fish in Pepper's shop at Oxshott.



gitimate sale of quick-frozen fish by retailers outside the trade. "What does he know about fish?" I heard one fishmonger ask recently, as he reached down a tin of pineapple chunks for a customer who mentioned blandly that she had bought some quick-frozen plaice fillets from the grocers opposite. The fishmonger had been selling all kinds of canned goods for 20 years.

In considering the present state of and prospects for the development of refrigeration at retail level in the fish trade, it is necessary to take into consideration all the changes and external influences just mentioned.

Refrigerated display is, if he did but know it, the only logical answer to all this competition because *the number of women who prefer to select from a mass of fish on the slab is diminishing every year*. The sales of quick-frozen fish through retailers other than fishmongers continue to go up and up; and, although the same cannot yet be said of pre-packaged wet fish, every pack that is sold in a supermarket is a sale lost to the fishmonger.

There has always been controversy among those fish retailers who have become converted to modern methods on the relative merits of refrigerated slabs and refrigerated cabinets. The protagonists of the cabinet method of display said the slab was doomed: it was an anachronism, a relic of the past. The supporters of slab display affirmed that housewives accustomed to buying from the slab would not take kindly to any other method. If it was necessary to display fish under temperature-controlled conditions behind glass, the obvious thing to do was to refrigerate and cover in the slab.

There are still fishmongers who swear by one method or the other, but there has been a tendency to compromise. Some have retained the open slab, supplemented by a cabinet. Some have had their slabs refrigerated but have left them uncovered because the action of lifting a glass flap or sliding a glass panel slows down the speed of service. At peak shopping periods, the fishmongers who have covered slabs frequently remove the doors, panels or flaps which would otherwise have to be handled twice every time a customer is served.



One of the five quick-frozen food cabinets—this one by Marco—in the Dagenham shop of Kipping's.

(Continued on page 85)

THE NEW

**FD**

# RANGE OF STERNE EVAPORATIVE CONDENSERS

(FORCED DRAUGHT TYPE)

FOR AMMONIA OR FREON

COMPACT YET ACCESSIBLE

STANDARD RANGE 20 T.R. to 150 T.R.

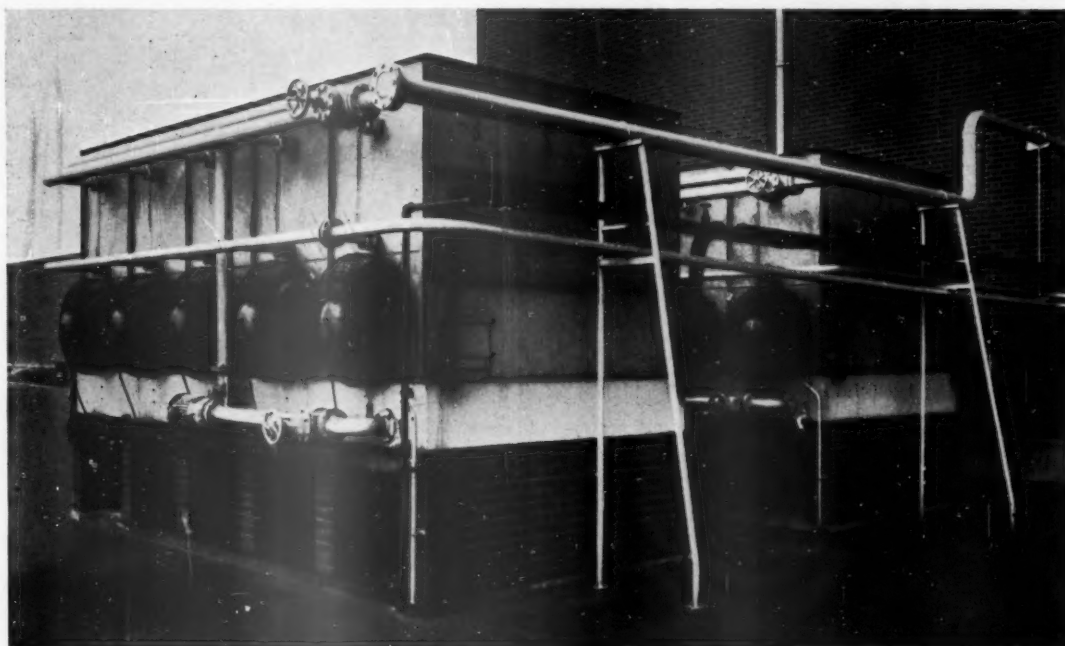


Photo by courtesy of Kraft Foods Ltd., Kirby, Liverpool.

The Photograph shows 2-133 T.R. units operating in conjunction with 2-285 H.P.—8VQC (V Type) compound ammonia compressors.

## SPECIAL FEATURES:—

*Efficient condenser element of novel design with low resistances.*

*Quiet, low speed fans.*

*Special water distributing system.*

*Negligible windage loss.*

*Easy to clean and service.*

## L. STERNE & CO. LTD

SALES OFFICES AND SERVICE DEPOTS:

**DERBY**  
**BRISTOL**  
**CARDIFF**

**LONDON**  
Derby 45604  
Bristol 24038  
Cardiff 26408

TRAFALGAR 3517

**NEWCASTLE**  
**HULL**

**LIVERPOOL**

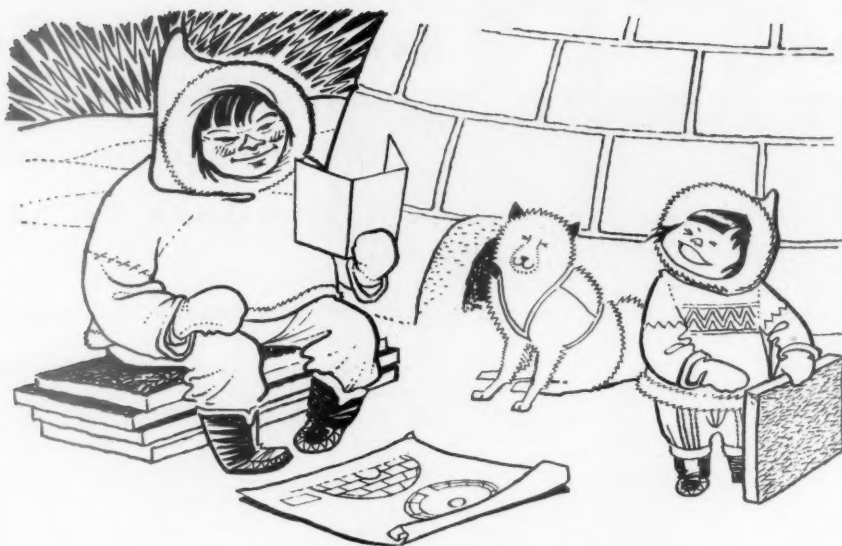
Royal 1281

**ABERDEEN**  
**BELFAST**  
**DUBLIN**

Aberdeen 24914  
Belfast 59211  
Dublin 62705

(Incorporating Haslam Foundry & Engineering Co. Ltd.)

**CROWN IRON WORKS, NORTH WOODSIDE RD., GLASGOW, N.W. Douglas 6461**



## now... we use ROCKSIL

For keeping cold in its place there's nothing like 'ROCKSIL', the latest British synthetic inorganic fibre, produced by a modern controlled manufacturing process from natural Scottish rock. 'ROCKSIL' is available in a variety of forms to suit every requirement. 'ROCKSIL' is the first really universal thermal insulating material.

The basis of all 'ROCKSIL' products is a white, fleecy wool—a low-density, resilient mass of

long, fine, siliceous fibres. These long fibres interlock in compression and are thus proof against vibration and settling. 'ROCKSIL' is free from slag or sulphur, chemically inert, non-hygroscopic, odourless and rot-proof.

There is a 'ROCKSIL' product for all cold insulation requirements—for domestic refrigerators, cold rooms, refrigerated cargo spaces, provision stores, refrigerated vans, deep freeze cabinets, etc.

### LOOSE ROCKSIL

*For all forms of cavity packing.*

### RESIN BONDED SLABS

*In various thicknesses and densities, which can be readily cut to shape.*

### LIGHTLY BONDED MAT

*In flexible roll form.*

*Send for further details and literature :*

## ROCKSIL<sup>regd.</sup>

ROCK WOOL INSULATION



*Manufactured and marketed by*

**THE CAPE ASBESTOS COMPANY LIMITED**

114 & 116 PARK STREET, LONDON, W1. GROSVENOR 6022

and at: Glasgow: Eagle Buildings, 217 Bothwell Street, Glasgow C.2. Tel: Central 2175

Manchester: Floor D, National Buildings, St. Mary's Parsonage, Manchester 3. Tel: Deansgate 6016-7-8

Birmingham: 11 Waterloo Street, Birmingham 2. Tel: Midland 6565-6-7

Newcastle: 19 & 20 Exchange Buildings, Newcastle. Tel: Newcastle 20488

Also distributed by: **WILLIAM KENYON & SONS LTD**, Dukinfield, Cheshire. Tel: Ashton-under-Lyne 1614



**SHOP REFRIGERATION NEWS***(Continued from page 82)*

**Left: At Braintree, L. C. Goodwin Ltd. operate this Hussmann display cabinet for wet fish in the window.**

**Below: Also in Goodwin's shop is this Prestcold quick-frozen food cabinet.**

In three respects, the open-topped cabinet appears to have advantages over the refrigerated covered slab.

1. There is a constant and completely controlled circulation of cold air around its contents.

2. The fish is out of reach of the relatively warm ambient air and completely protected from draughts which prevent the maintenance of an even temperature.

3. There are no covers to remove in order to give access to the fish for service.

The advantage of refrigerated slabs, covered or otherwise, is that:—

(1) They preserve the traditional and characteristic appearance of the fish shop.

(2) Generally having a larger refrigerated surface than the cabinet, they provide better facilities for display.

(3) They lend themselves better to island display: customers can generally view the fish from at least three sides.

A less frequently used form of refrigerated display is the window base. The advantages of this over the larger slab are:—

1. Being shallow, its contents can be covered by cold air dispensed over coils fitted beneath the riser at the back.

2. Even if it is not covered, it is at least protected from street dust by the window and customers can make their selection from outside.

3. Service can be given from the back, leaving the rest of the shop free for the introduction of displays of dry and smoked fish, crustacea, and quick-frozen foods.

Another subject for controversy is the financial method by which cabinets are acquired, by out-



### SHOP REFRIGERATION NEWS

right purchase or hire-purchase or on the rental principle.

There can be little doubt that where capital is available outright purchase direct from the maker, combined with an arrangement for maintenance over a given period, is more satisfactory in that it reduces costs and relieves the retailer of any further commitments. Hire-purchase may be necessary as a means of reducing initial outlay and spreading over-payments.

The rental system has tended to be more frequently used of late. With its maintenance and replacement service and 24-hour emergency stand-by of a repair staff, it is welcomed by some fishmongers who wish to be free of all responsibility for the condition of the cabinet.

Progress can be measured only by actual installations. Let us take a cross-sectional view of shops that set a standard for the advance of refrigerated fish display during 1958.

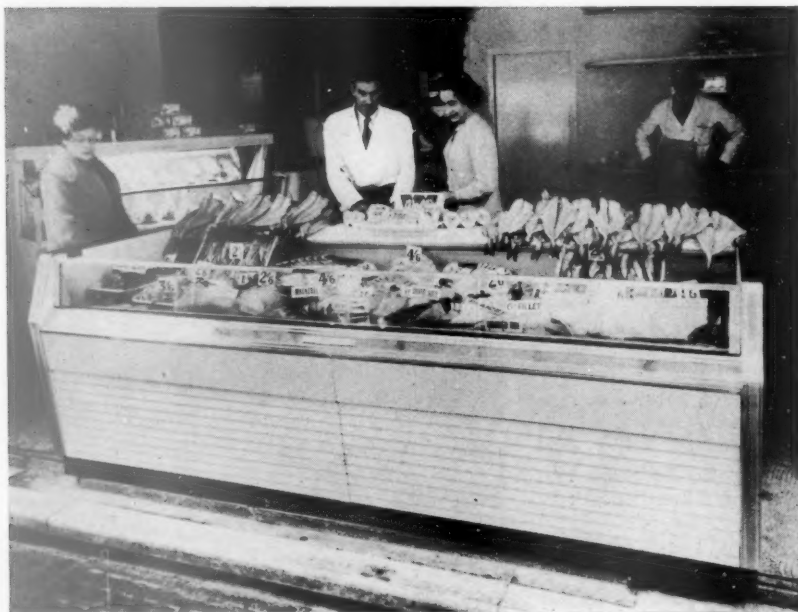
One example of refrigerated equipment supplied on the hire principle is provided by the shop of Mr. A. F. Pepper of Oxshott, Surrey, who has a glass-fronted cabinet for quick-frozen foods, another for poultry, and a refrigerated slab for wet fish, all supplied by Electro Rentals, Ltd.

One of the most remarkable installations in the fish trade is to be found in the shop of Mr. Leonard Mickelborough (trading under the name of Kipping) at Broad Street, Dagenham, Essex. Here there is not refrigerated display for fresh fish, all of which is shown on a stepped slab in the centre of the shop. But there are no fewer than five low-temperature cabinets for quick-frozen food. Each cabinet is given up to a specialised group, as follows: (1) fast-selling lines; (2) cooked foods including all brands of fish-fingers and fish-sticks; (3) fish; (4) poultry, sausages, and meat; (5) reserve supplies.

#### Use of Colour

At Braintree, Essex, there is a very fine shop owned by L.G. Goodwin, Ltd., which has a "Husmann" refrigerated display cabinet in the window, the blue ripple-finished front of which links up with the two-tone blue colouring of the facade and shop-front, and immediately facing the door is a "Prestcold" low-temperature cabinet for quick-frozen foods.

A record in compact installations is the shop of Mr. Barton at Guildford. This has a refrigerated window bed from which an over-the-counter service is given, and wedged in a recess at the back of the shop is a small "Husmann" cabinet for quick-frozen foods.



Fine open-vision display is provided by this Husmann British cabinet at Wyatt's, Gloucester Road, London.

# CONDENSER UNIT PROTECTION

*Adequate supply of cooling water  
by the NEW*

## *Teddington* 'GK' WATER VALVE

- ★ COMPENSATES FOR VARIATIONS IN WATER PRESSURE.
- ★ COMPACT IN BUILD.
- ★ SIMPLE TO INSTALL.
- ★ FLEXIBLE DIAPHRAGM PREVENTS LOSS OF REFRIGERANT.
- ★ THOROUGHLY RELIABLE.
- ★ REFRIGERANT PRESSURES TO 250 p.s.i.

The new *Teddington* GK Water Valve is specially designed to pass an adequate supply of cooling water to the condenser, under strictly controlled conditions. The valve body is a hot brass stamping with  $\frac{3}{4}$ " B.S.P. female connections allowing, with adaptors, a wide range of connections to be made. The pressure bellows compartment is sealed by a synthetic rubber reinforced diaphragm. Highly flexible, this can withstand water pressures to 150 p.s.i., and also prevents loss of refrigerant. The opposing spring compartment is similarly protected against possible water entry. With the two diaphragms mounted at opposite ends of the spacer, changes in supply pressure will not affect the valve operation. Setting is adjusted by a handwheel. Well balanced, neat and compact in construction, the *Teddington* GK is easily installed and handled.



## *Teddington*

**TEDDINGTON REFRIGERATION CONTROLS LTD**  
**SUNBURY-ON-THAMES . . . . MIDDLESEX**

Tel : Sunbury-on-Thames 456.

Telegrams & Cables : TREFCON, SUNBURY-ON-THAMES.

Telex : 22742 TEDDCONTSNBRY

London Stockists: H.R.P. Limited, 99 Kings Road, Chelsea, S.W.3

TR31

# International News

## Venezuela

Comercial Nunez C.A. of Boleita, Calle Santa Ana, Pasaje Comercial (Frente Granja Arroyo), Apartado 5807, Caracas, have informed the British Embassy at Caracas that they would like to receive quotations from United Kingdom firms for many engineering products including industrial refrigeration plant and refrigeration accessories and controls.

## Poland

The International Trade Fair which is held annually at Poznan offers an opportunity for United Kingdom manufacturers to meet representatives of the Polish State buying organizations. This year the dates are June 8 to 22. At the 1957 fair almost 50 per cent. of the space taken was occupied by non-Polish exhibitors numbering 1,745 foreign firms as against 1,611 Polish exhibitors. Visitors numbered over 900,000 and there were 4,730 foreign visitors registered by the Polish authorities. At the 1958 fair there will again be British sections under cover and in the open. Application for space should be made direct to the Poznan International Fair, 14, Glogowska Street, Poznan. Application forms can be obtained from export publicity and fairs branch of the Board of Trade, Lacon House, Theobalds Road, London, W.C.1. The final date for receiving applications in Poznan is February 15.

## India

Because of their current balance of payments difficulties the Government of India are restricting the import of all goods to the essential minimum. Import licences are required for virtually all goods and importers of capital goods and heavy electrical plant have been warned that permission to import these goods may be withheld unless suitable credit terms are obtained. United Kingdom exporters of these goods are, therefore, advised that before opening negotiations with private Indian importers they should find out whether "a letter of authority or intent" has been obtained and, if so, what payment terms it specifies; and where the goods are for supply to the "public sector," e.g. to a purchasing or indenting department of the Central or a State Government, or to public authorities such as Port Trusts or governmentally-owned factories, they should find out what credit terms have been stipulated by the Department of Economic Affairs.

## Pakistan

Under the I.C.A. procurement for Pakistan, tenders are sought for six refrigerators, the description being "electric, self-contained, one-door, storage capacity 11 c.ft., over-all dimensions 40 in. by 30 in. by 68 in., type 1, domestic, 110° F. ambient temperature, in accordance with U.S. Federal Specifications No. AA-R-211C; motor shall be designed for 220 volt, 50 cycle, single phase, a.c., or provided with suitable stepdown transformer." Closing date is January 22.

## U.S.A.

The Board of Trade's special register circular GEN/3665 issued on August 15, 1957, gave details of the Supermarket Institute Show to be held in Cleveland. The B.o.T. has heard that the Institute have decided to change the location of the show, and it will now be held at Atlantic City Auditorium, Atlantic City, New Jersey from May 25 to 28.

## Japan

During the next 12 months, Japan is estimated to be buying over £3,000,000 stg. worth of second and third

grade New Zealand beef. Japan's only source for meat has previously been Australia, but the free quota (15,000 tons) has prevented Australian exporters from meeting the demand. Lack of refrigerated shipping space has held up any substantial imports by Japan from N.Z. formerly. Recently, a Panamanian registered undertaking, the Shiro Trading Co., overcame the lack of refrigerated shipping space from New Zealand by chartering Japanese whaling ships. The small 500 to 800 ton, fully refrigerated whalemeat carriers are now making regular monthly runs to New Zealand during the whaling off-season. The Shiro Trading Co. claims this is the only profitable shipping method, for larger ships would bring too much at a time for the limited cold storage space available at Tokio and Kobe ports. This company has contracted to import 5,000 tons of second and third grade N.Z. beef during the three-month period April to July, and the beef is selling on the Japanese market for about 120 yen per mome (about 2s. stg. a lb.). Three Japanese canning companies have imported about 3,000 tons for their own use, bringing the total for the three months to 9,000 tons c.i.f.

## Australia's Prosperity Linked with Refrigeration

By A. N. CURPHEY

REFRIGERATION has always been of prime importance to Australia. It is one of the pillars of the nation's prosperity. It was largely due to the invention of refrigeration that the colony—as it was then—was able to find a ready overseas market for its meat.

Hitherto, the market was purely localized. As meat could not be shipped to England or Europe unless it was kept fresh. It was an Australian, James Harrison, who found the solution. The first vapour compression refrigeration machine was actually invented in his little workshop at Geelong.

(Continued on page 91)

## Girdlestone for PUMPS

Suppliers to the  
leading refrigeration  
plant manufacturers

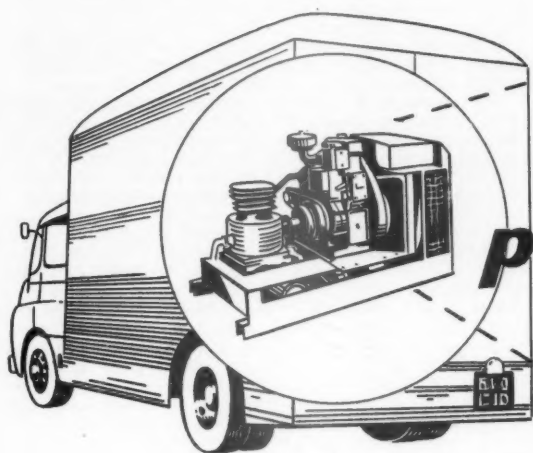
**Girdlestone**  
PUMPS LTD.

23 DAVIES ST., LONDON W.1.  
Telephone: MAYfair 1354





# refrigeration . . .



**SMOOTH - RUNNING**

**p o w e r**

**FULLY AUTOMATIC**

**by LISTER**

## **diesel engine**

Lister air or water-cooled engines provide a reliable and smooth-running power source for refrigeration units.

Ideal for cold storage transport vehicles.

*Electric starting and fully automatic control equipment available.*

### **Technical Advisory Service**

The Lister organisation includes a Staff of Specialist Engineers with wide experience in the design, operation and installation of diesel engines. Their services are freely available for advice and consultation upon request.

**R. A. LISTER & CO. LTD.**

**DURSLEY · GLOUCESTERSHIRE**

Telephone : Dursley 2371

Telex : 43-230

LONDON OFFICE :

**IMPERIAL HOUSE, KINGSWAY, W.C.2** Temple Bar 9681

# REFRIGERATION PATENTS

These new refrigerating patents have been specially selected for readers by MODERN REFRIGERATION from the Official Journal of Patents, and are published by permission of the Controller of H.M. Stationery Office.

## APPLICATIONS RECEIVED

November 1—Anglo American Export Co. Ltd., Kon, M., P34239, Air-conditioning appliance. 15—General Electric Co., Ltd. and Saunders, N.F.T., P35666, Refrigerator evaporators. 18—Proudlock, W. W. E., P35788, Refrigerating system. 20—General Electric Co., Ltd., Williams, C. E., P36007, Refrigerator display case. 23—Cuddon, Ltd., W. G. G., Cuddon, W. G., P36575, Refrigerating apparatus. 25—Heron, A. G., P36596, Refrigerating Apparatus. 26—Nicolson, F., P36748, Beer refrigeration etc. treatment.

## COMPLETE SPECIFICATIONS ACCEPTED

November 27—General Electric Co., 789,537, Refrigerators having automatic defrosting systems; Godfrey (Haworth) Ltd., formerly Godfrey & Partners (Holdings), Ltd., Sir G., 789,601, Air-conditioning apparatus; General Electric Co., 789,452, Refrigerator cabinets. December 4—Hoyer, O.G., 789,706, Ice-cream freezing machines; General Motors Corporation, 789,957, Refrigerator. 11—Heron, A. G., 790,111, Electrical defrosting means for use with refrigeration apparatus; Sulzer Freres Soc. Anon., 790,355, Compression refrigeration apparatus.

## The Low-Temperature Separation of Air

THE British Oxygen Company Ltd., of Bridgewater House, Cleveland Row, St. James's, London, S.W.1, has been granted British Patent Specification No. 786,296 on an invention relating to the processes for the separation of air by liquefaction and subsequent rectification, of the type in which two main fractions are obtained, one rich in oxygen and one rich in nitrogen.

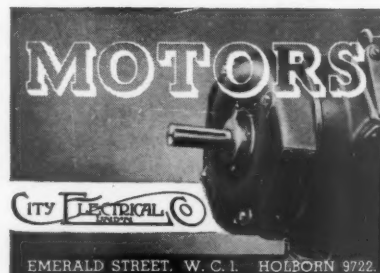
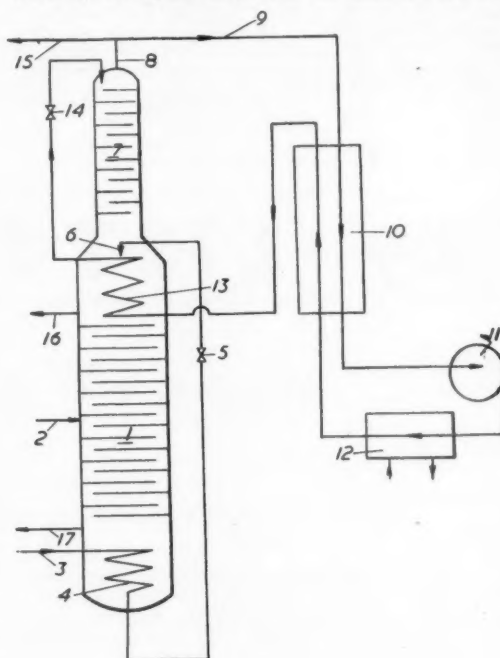
It is an object of this invention to provide an air separation process of this type by means of which at least a part of the nitrogen is obtained at high purity and as gas.

According to the present invention, a process for separating gaseous nitrogen in a substantially pure form from air comprises treating air in a primary rectification zone in such a manner as to produce therein as one of the separation products a gaseous fraction enriched in nitrogen, feeding at least part of such gaseous fraction to a secondary rectification zone arranged as an upward extension to the primary rectification zone and in open communication therewith, withdrawing substantially pure nitrogen in gaseous form from the top of the secondary rectification zone and condensing by heat exchange with liquid air a part of the withdrawn pure nitrogen for use as reflex liquid in the secondary rectification zone.

The primary rectification zone may be either a single or double column, operating in the usual manner to produce oxygen and nitrogen enriched fractions.

The invention will now be more particularly described with reference to the accompanying drawing which shows diagrammatically the rectification section of an air separation process according to the invention using regenerators for cooling and purifying the initial air supply to the rectification section. For the sake of clarity the air compression and regenerator systems are not shown.

The air entering the plant is divided into two streams, One stream is compressed to a relatively low pressure, cooled in known manner in one pair of generators by heat exchange with a part of an effluent nitrogen fraction produced by the separation process and thereafter fed to a



primary rectification zone in the form of a single column 1 through a pipe 2. The other air stream is compressed to a higher pressure, cooled in two further pairs of regenerators by heat exchange with the remainder of the effluent nitrogen fraction and an effluent oxygen fraction from the column 1, and passes through pipe 3 to a coil 4 immersed in the liquid oxygen at the bottom of column 1 where it is condensed by heat exchange with the boiling oxygen at the base of the column and thence fed through expansion valve 5 into the top of the column 1 at 6 to serve as reflux liquid therein.

In accordance with the invention, a secondary rectification zone in the form of a secondary column 7 is mounted on top of the primary column 1 and communicates therewith so that a part of the vapour from the top of the primary column 1 passes up through the secondary column 7.

A stream of pure gaseous nitrogen is withdrawn at 8 from the top of the secondary column 7 and divided into two parts. One part passes through pipe 9 to a heat exchanger 10 where it is warmed by heat exchange with the returning pure nitrogen stream as hereinafter described, and thence to a compressor 11 where it is compressed to a moderate pressure. The pure nitrogen stream from the

compressor 11 passes to an after-cooler 12 where it is cooled to remove the heat of compression, and is then returned through the heat exchanger 10 in countercurrent flow to the stream before compression. The cooled compressed stream passes to an exchanger 13 where it is liquefied by heat exchange with the liquid air serving as reflux in the primary column, and is then expanded through valve 14 and fed as reflux liquid to the top of the secondary column 7. The heat exchanger 13 may be located within the primary column 1 as shown in the drawing, or, alternatively, it may be a separate unit located outside the column.

The other part of the effluent pure nitrogen stream is led out of the plant through pipe 15 as the required pure nitrogen stream, the cold therein being recovered in heat exchangers by cooling part of the incoming air.

An impure gaseous nitrogen fraction is withdrawn from the top of the primary column 1 through pipe 16 and a gaseous oxygen fraction from the lower end of the primary column 1 through pipe 17. These fractions pass through the regenerators to cool the incoming air as previously described.

## AUSTRALIA AND REFRIGERATION

(Continued from page 88)

Apart from the potential meat export market there was a ready demand for refrigeration within Australia. The growth of population and a steady migration from the coastal centres to the interior were creating problems which could only be overcome by refrigerated storage, for the long distances involved, particularly in the more outlying districts, made it difficult to obtain frequent and ready supplies of foodstuffs.

It is estimated that the number of refrigerators in use in Australia by 1939 had reached 200,000 representing a 10 per cent. penetration of all homes. In 1949 the total had increased to 450,000 domestic refrigerators equipping 23 per cent. of all homes. By 1955, it was estimated that approximately 1,820,000 refrigerator units were in use, which had lifted the penetration to an estimated 75 per cent.—almost the highest figure in the world.

The general level of prosperity, high living standards of the population, rate of family formation, immigration, home building activity, and trends in food preservation which require more refrigeration space are the main factors in this growth. With the population still increasing by nearly 100,000 a year there is certain to be a continuous expanding market for the use of deep-freezers, low temperature refrigerators and window air-conditioning equipment. Australia has a climate which requires some form of cooling throughout the extended summer period.

Surveys are being made by the government regarding the use of bulk milk refrigerators on farms. This could open up new possibilities in

the industry, for if such a scheme proves successful the range will probably be extended to cover other primary production.

The plan considered for dairy farms is briefly this. As the cows are milked the milk will run straight into refrigerated vats. A tanker will come every two days to take away the milk. The advantages of this system are many; it is more hygienic, transport costs are reduced, and the farmer is saved the trouble of storing the milk.

Victoria is particularly interested in this scheme. Although the smallest State she has 11,000 dairy farmers supplying liquid milk to factories and depots. And as expansion grows throughout the country so the need for refrigeration increases.

Industries affected by refrigeration include the baking industry (which needs some measure of control over dough temperature), brewing (for fermenting and storage), butter and cheese, canneries, confectionery (for bulk storage and production), eggs and poultry, fish, meats, and fruit and ice cream. Moreover, the State's industry is constantly expanding. In addition to the establishment of new industries, older ones with an eye to the future are investing in modern equipment. Hardly a week goes by without some firm, large or small, announcing development plans.

Australia believes in putting her future "on ice" but not into cold storage.

*Frozen Foods* is obtainable from the manager, Maclaren House, 131 Great Suffolk Street, London, S.E.1, at fifteen shillings per annum, post free to any part of the world.

## 'MR' small ads

Prepayment of Classified advts. is requested.

Replies to Box No. advts. to be addressed to  
Box No. —, MODERN REFRIGERATION,  
Maclaren House, 131 Great Suffolk Street,  
London, S.E.1.

### AGENCIES REPRESENTATIVES, ETC.

6d. per word. Minimum 12/6. Box 2/- extra.

**EXPERIENCED** salesman required, New Year, by West Country distributors famous make commercial refrigeration manufacturing own cold rooms, cabinets, etc. Good service organisation. Established and productive territory. Exceptional opportunity of remunerative, permanent, progressive position for man of high integrity and initiative. Details to Box 826. 826

**SALESMAN** for Commercial Refrigeration for North London and West Middlesex. Salary, commission and expenses.—Harden & Co. Ltd., 124, The Broadway, N.W.2. GLA 6606/7. 831

**REFRIGERATION** and Air Conditioning firm in British Columbia desires agency for refrigerators.—Box 837. 837

**SALES** Representative required by London Distributors of Frigidaire. Salary, expenses and commission. Experience not essential provided applicant has ambition to become a professional salesman. Write full particulars to Haynes & Orenge Ltd., 97, Peckham Road, S.E.15. 840

### SITUATIONS WANTED

6d. per word. Minimum 5/-, Box 2/- extra.

**THERMAL** Insulation Materials. Senior Executive in prominent company selling insulation products would consider offers of employment from similar concerns.—Box 838. 838

**SERVICE** Engineer (Manager), aged 35, seeks change. Conversant domestic, commercial and industrial applications. At present residing Midlands, other areas considered.—Box 847. 847

**REFRIGERATION** Service Engineer, experienced (in charge), seeks outlet for talents. Any interesting and progressive position considered.—Box 848. 848

### SITUATIONS VACANT

6d. per word. Minimum 12/6. Box 2/- extra.

**TECHNICAL SALES ENGINEER.** An opportunity occurs as Director's Assistant. Position entails both office work and outside selling. We envisage an educated C. & G. graduate under 27. Write in confidence for appointment with brief career details to Refrigerator Components Ltd., 1/2, Greycoat Place, Westminster, London, S.W.1. 764

**REFRIGERATION** Design Engineer. Must be qualified senior man with experience in design of wide range of Refrigeration Cabinets, coldrooms and various equipment up to 10 h.p. Top salary will be paid to responsible person with initiative and there is ample opportunity for advancement. Apply giving full particulars to—Marco Refrigerators Ltd., Rowan Road, London, S.W.16. 573

**HAYNES & ORENCO LTD.,** Frigidaire Distributors, South London, require Service Engineers with commercial refrigeration experience. Van provided. Top rates paid plus commissions, also bonus. Applications treated confidentially. Write or telephone 97, Peckham Road, S.E.15. RODney 5661. 685

**ENGINEER** to take charge of engineering side of Cold Store in London area. Able to take over plant of N.H.3 and also do other duties. Reply stating age, experience and salary required.—Box 809. 809

**REFRIGERATION** Engineer required in Surrey for production of Refrigerated Display Cabinets. Must have experience in the control of men and knowledge of assembly. Reply to Box 827. 827

**SERVICE** and Installation Engineer experienced 4-15 h.p. equipment, living S. London or S.E. Essex preferred. Good rates and prospects. Apply Metropolitan Refrigeration Ltd., 73, Charterhouse Street, E.C.1. 828

### REFRIGERATION ENGINEER

An experienced man is required by large Oil Company operating in the Persian Gulf to take charge of Refrigeration and Air-Conditioning. Applicants should have served a full apprenticeship and have had considerable experience of installation, operation and maintenance of refrigeration and air-conditioning plant. Possession of A.M.I.Mech.E. an advantage but First Class M.O.T. Certificate and experience on refrigerated ships would be a suitable alternative. Service is on three-year agreements (renewable), but home leave with paid passages is granted after two years. Pensionable pay not less than £1,400 per annum plus large local allowances. Age limit 40 and bachelor preferred owing to shortage of married accommodation. Write in detail, quoting No. 761 to Box 1363, c/o Charles Barker & Sons Ltd., Gateway House, London, E.C.4. 829

**APPLICATIONS** Engineer required by York Distributors in Midlands. Applicant must have had previous experience in Commercial Refrigeration Equipment up to 15 h.p. Progressive post with good future. Apply in writing in first instance to Kroy Refrigeration Ltd., 73, Gt. Hampton Street, Birmingham, 18. 835

MODERN REFRIGERATION January 1958



